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A Weekly Review of Progress in

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FIRE-CONTROL PLATFORM, U. S. S. "PENNSYLVANIA", AS SEEN FROM BROOKLYN BRIDGE

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Electrification of Merchant Ships

THIRTY YEARS AGO we had "horse cars," four-story office buildings, oil and gas for lighting, factory power from a single steam engine, and the old "steamboat."

TODAY we have electric street and interurban railways, electric locomotives, fifty-six story office buildings, individual motor driven factory machines, and we are electrifying ships.

IN THE NAVY there are already single vessels in service or building with electric power plants ranging from 6000 horsepower to 180,000 horsepower.

WHY are Merchant Ships being electrified? To save fuel, labor and time, both in port and at sea, thus placing the shipping industry on the same economic basis as are other modern American industries.

Foreign credit will soon be restored and the industry of Europe will be reconstructed. There will be use for a large American Merchant Marine. Ships that are idle, and too expensive to operate, can be made into profitable carriers by electrification.

The success of the American Merchant Marine will depend largely upon its electrification.

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There is a large corps of Westinghouse Engineers who have not only studied marine problems but have successfully applied electric apparatus to the needs of shipping.

For planning new ships or reconditioning old vessels to obtain better economy, Westinghouse Marine Engineering assistance is available on the following applications:

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- Power Distribution and Control
- Geared Turbines
- Motors for Cargo Handling Machinery
- Motors for Steering Gear and Windlass
- Motors for Galley Appliances
- Electric Heating Apparatus
- Radio Equipment

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ELECTRICAL EQUIPMENT FOR MERCHANT SHIPS

SEVENTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

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Something New in Electric Furnaces

By E. F. Cone

AN electric furnace with a repelling arc is the latest addition to the important industry of melting or refining steel or non-ferrous metals by electricity. It is unique in many respects and is a highly interesting addition to this industry. It is really an electric torch. It has been developed by a Chicago electric furnace company and is already in use in melting brass and copper and in making aluminum steel. It is known as the von Schlegell repelling arc furnace and is the invention of the president of the company. A brief description follows:

Many electrical people have asked what we mean by the phrase "repelling arc," what are its advantages and why. It is a self-regulating, flaming arc torch which can be operated from 220-volt motor circuits and suspended into various kinds of chambers for high temperature with deoxidizing conditions maintained.

In answer to the question, "What is the repelling arc?" we offer a drawing which reveals the reason why we call it a torch suspended in a furnace body. By dotted lines we have indicated the electrodes in a relapsed position which the electrodes take when there is no current passing. The bottom ends touch each other. They are drawn together by adjustable weights, as indicated. As soon as current flows, the repulsion between electrodes and the flow forces the electrodes apart, thus drawing the arc.

The electrodes, it will be noted, are placed about the same as electrodes are placed in a flaming arc lamp and the arc is very similar to that given by a flaming arc lamp. It will be noted that the operation of this arc differs from that of other arcs in that the usual practise in drawing arcs is by longitudinal movement of the electrode, while in this case it is entirely accomplished by lateral movement and the repulsion between electrodes is the force which gives this lateral movement. This repulsion also drives the arcs down from the ends of the electrodes.

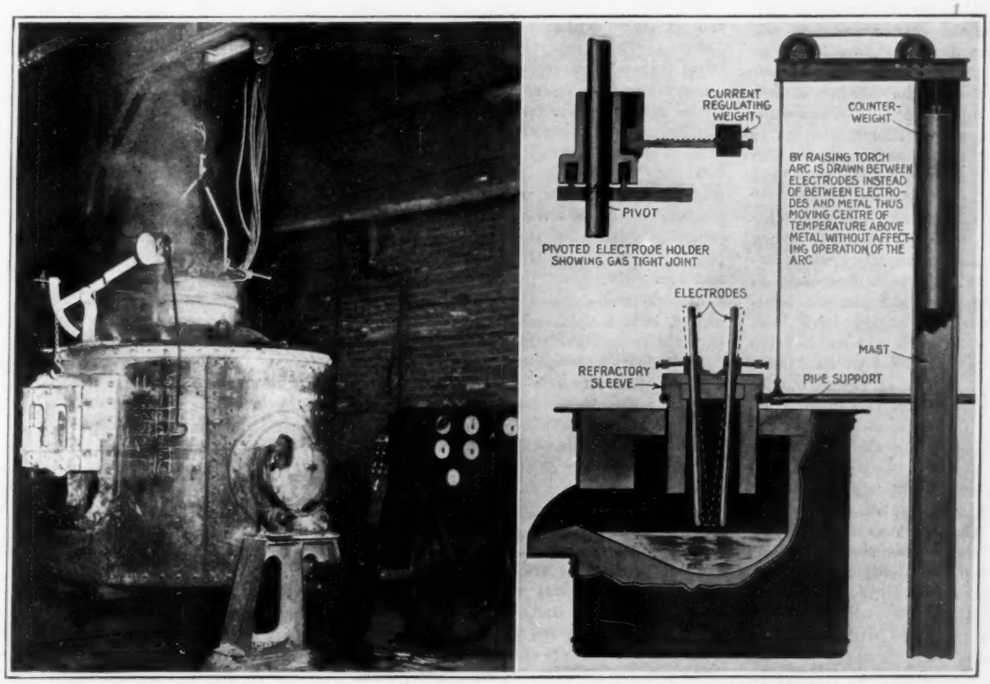
One of the most desirable things in electric arc furnaces is to overcome the fact that with the changes of temperature and melting of the material in the furnace, as well as the wear of electrodes, the influences affecting the current in the arc are constantly changing to make the arc unsteady.

Another important advantage is the fact that because the electrodes can be raised and lowered as a unit, or in a cluster, rather than individually, it is possible to use gas-tight electrode joints. This prevents any flame coming up around the electrodes, prevents the rapid wear on electrodes which occurs in other types of furnaces, and obviates the necessity of water-cooled electrode holders.

The fact that all three electrodes are handled in a cluster, and that the arcs are inherently self-regulating, makes it possible to suspend the same cluster or torch alternately in either one of several furnace bodies. Thus there may be instances where the industrialist has two furnace bodies with the torch suspended into one, while the other is being charged and preheated with oil. This really makes possible the use of two furnaces with the cost of but one set of electrical equipment. One shell may be basic and the other acid, or the two shells may be used for melting different metals.

On the von Schlegell furnaces no adjustment is made of the electrodes during heats. The torch is merely lowered during the process as the material melts down.

Other applications of this torch for industrial purposes would be in heating furnaces for forging; melting the alloys and heating large ladles preparatory for adding charges; for work on non-conductive materials, particularly such classes of metallurgical work where it is desired to hold an intense heat within a body of ore or sand, similar to the manufacture of manganese, glass, etc.



General view of the electric furnace with the repelling arc, and a sectional view and details of this new form of electric furnace

Artesian Reservoirs for Intermittent Supplies of Energy

THERE are many sources of power in Nature—the sun's radiation, wind, the tides and waves of the sea—which could be turned to the use and convenience of man were it not for the difficulty that they are intermittent or irregular, whereas practical applications in general demand a more or less constant supply. This difficulty would be overcome if a cheap method of storage could be found, such as would enable the deficiency of the lean periods to be made up by the surplus of the fat ones.

A Rumanian engineer, Mr. A. Beldimano, sends an interesting suggestion for the solution of this problem, based on his experience in the oilfields of his own country. He points out that, as is well known to geologists and practical oil-engineers, clay strata, even when only a few feet thick, are absolutely gas-tight and water-tight, as is shown by the fact that natural gas has been kept compressed under them, at a pressure perhaps of 100 atmospheres, for thousands of years, until man began to piece them by sinking wells. He therefore proposes to drill deep artesion wells at the highest point of an anticline where a water stratum is to be found beneath a fairly thick clay stratum, and to drive his energy in the form of compressed air into the well, when the air will replace the water in the pores of the sand of the water-stratum. In this way he would obtain a cheap and absolutely air-tight container of any desired capacity. In connection with this plan he points out that in Germany old disused collieries have already been used as reservoirs for storing air under pressure, being rendered air-tight by a lining of clay. The compressed air in the reservoir could be conveyed by pipe lines to any desired point and used in motors for the production of mechanical power, or an electrical power station might be established at or near the reservoir and the power transmitted electrically.

The second part of his scheme contemplates the production of large quantities of compressed air at a pressure of say, 10 atmospheres from the energy of the waves of the sea, continues *The Times Engineering Supplement*. For this purpose he would anchor pontoons in the sea at a suitable distance from the shore, and would install in them air-compressors with a simple mechanism operated by the varying tension on the mooring line as the pontoons are moved up and down by the waves. The compressed air thus obtained would be conveyed by pipe lines to the artesian containers on land. Mr. Belimano points out that this method of harnessing the waves would require no pier or masonry work on shore, and that the pontoons containing only the simplest engines, which would need no attention, except for an occasional inspection a few times a year, could be constructed in any shipbuilding yard and need only be moored in a special way by anchors, like lightships. As the size of the power plant would depend on the number of pontoons in operation, it would be possible to begin with a comparatively small installation, and subsequently enlarge it, according to requirements. Both these schemes seem most ingenious on their face, but their practical value remains to be proved in actual test.

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The Illuminated Highway

MODERN highway engineering has ramifications that would have transcended the imagination of a Telford or a Macadam. Consider the matter of highway lighting, remembering that it is a bare century since street lights in the largest cities had any function other than the mere marking of corners. Surely a generation ago any suggestion that our ordinary highways over the countryside might ultimately be lighted would have seemed fantastic.

Yet today one of the outstanding problems of highway practice arises from the effort to light the way of the motorist in the open country. Here less than in any other detail of highway construction and maintenance has current practice crystallized into an accepted standard. Today we admit, even when we do not build our roads of concrete, that concrete is the stuff for roads. We agree that the grade crossing is tolerable only as an expedient. But with regard to the character of highway illumination at which it is desirable to aim we are still a good deal at sea.

The idea behind all road lighting is simple enough. Even at the crawling pace of horse and buggy, driving is safer when one can see the road ahead. At the automobile's speed the hazard of darkness is so increased that some means of illumination becomes imperative. It was not possible for the horse-drawn vehicle to display a light which should do more than announce its presence. With such complete illumination as is afforded in city streets it is not necessary for the automobile to go beyond this, as the universal use of the dimmest of parking lights in city driving attests.

In the country, pole lights have not been needed for ordinary purposes and have not been installed. When automobiling attains a degree of generality which demands effective lighting, it is therefore necessary to make a choice between the pole light and the headlight. The disadvantages of the latter have been unduly emphasized and its advantages have had too little attention. It is true that a light which dazzles the approaching driver is a source of actual danger rather than of safety. Ten years ago this might have been a pertinent objection to the headlight—but ten years ago nobody was proposing the use of the pole light as standard highway practice. Today, when it is not alone proposed but in large measure practised, the objection to the headlight upon which it is chiefly predicated has been met. The man who drives with a dazzling light does so by choice, and should have as little consideration from the community as he gives.

The average highway passes through more or less of wooded or shaded territory; it curves with a good deal of freedom; it is liberally sprinkled with hills, long and short, steep and gentle. The presence of trees means that the pole light, no matter how skilfully located, will throw shadows upon the roads; and this condition is greatly accentuated by curves, which make a greater length of road susceptible to the influence of a single light. Everyone who has ever driven in the country at night knows how puzzling these shadows may be when at rest, how alarming when in motion. The wholesale trimming of the trees would perhaps be a remedy, but we do not suppose it will be seriously advocated. We have yet to see, on the other hand, a headlight that will throw a shadow save where there is really an obstacle in the road; and it is more likely to show this obstacle in its true form than as a silhouette whose real significance must be guessed. Again, where the roadside is comparatively unobstructed, every little curve and every slight rise means that two consecutive pole lights will take on the appearance of an approaching car—or, much worse, vice versa. The combination of shadows with horizontal and vertical displacement of the lights lends to a long night drive over an illuminated road the character of an obstacle race—with the added touch that one must guess the location, the character, and even the reality of the obstacles.

For night driving along any road that was ever built our opinion is that no competent driver need ask anything more than the illumination of his own headlights, with single lights on the outside of the curves at the discretion of the authorities. These, however, should be frosted or otherwise fixed so as to throw no beam and hence no shadow. It would hardly do to make them red; it is hard enough to distinguish between the car ahead and the warning signal that marks the ditch-digger's unfinished work, without adding further complications. Points of real, active danger might be marked with a pattern of red lights, which could hardly be mistaken for anything save what they are.

Before spending a lot of money in cluttering our highways up with a vast number of useless and meaningless and confusing pole lights, would it not be well to pause for a moment and inquire whether the present status of the headlight is not sufficiently satisfactory to justify us in the expectation that whatever illumination a driver needs he may carry with him? Will not better satisfaction be got, in the long run, by confining the roadside light to the rôle of a signal?

Stretching the Electric Transmission Line

SOMEWHAT startling are the experiments recently conducted at the high voltage engineering laboratory of the General Electric Company at Pittsfield, Mass. We learn that the transmission specialists succeeded in stepping up the usual electric supply current to a potential of over one million volts, and in transmitting this enormous voltage a short distance. These experiments mark a new era in electrical transmission, to be sure.

Our friends, the newspaper writers, have quite wisely given these experiments a prominent position and display in their news columns. Why not? A million volts is a figure to conjure with, both with the layman and with the serious electrical engineer. But if we may be pardoned for the criticism, we feel that our newspaper friends have been too hasty in judging the immediate worth of these experiments with relation to their bearing on transmission problems of today and tomorrow.

Electric transmission, at least in its mathematical aspect, is a simple enough problem. We have three cardinal factors—voltage (or pressure), amperage (or rate of flow) and resistance of the line. To transmit current, we must overcome a certain resistance of any line, no matter whether it is a thousand miles long or an inch long. The more voltage we apply, the more readily we overcome the line's resistance. And since the working ability of electricity depends on watts, the product of volts times amperes, it matters little whether we pass 100 amperes at ten volts or ten amperes at 100 volts. In either event we obtain 1000 watts. But from the standpoint of transmission, it is highly important whether we are handling a higher voltage and less amperes, or vice versa. The more amperes we pass through the line, the heavier the line must be so as not to offer too much resistance, and hence a heavy loss, to the transmitted current. An alternative is to increase the cross-sectional area of the conductor, but that means a vast increase in the cost of the line, especially over long distances.

So all the development in electrical transmission of power has been toward higher and still higher voltages, so that enormous volumes of electrical energy can be passed through lines made up of moderate sized conductors. Higher voltages call for better insulation, better transforming devices, and better switching gear. Indeed, the electrical engineer has to assume a heavy burden with each additional increase in potential, so intricate are the insulation and manipulation phases of transmission.

The million-volt transmission experiments are still in the laboratory, let us not forget. In actual practice we are now about to open a 220,000-volt transmission line in southern California, which is a vast stride forward from those early days of long-distance electrical transmission back in 1891, when the first high-voltage line of 15,000 volts was inaugurated. And from 220,000 volts to 1,000,000 volts there is a still greater gap—one that must be bridged with no end of experimental work and engineering ideas and practical experience in the making of still better insulators, switching gear, transforming equipment and so on. Still, the experiments prove that one million volts can be handled with proper equipment, and that the day may come when we shall transmit electricity from the glaciers of Alaska to the gay lights of Broadway. But this will not be tomorrow, nor the next day; it may be several decades from now.

Few men are better qualified to speak of this important subject of electric transmission than Dr. Charles P. Steinmetz, Chief Consulting Engineer of the General Electric Company. Some time ago we asked Dr. Steinmetz to write an article for the November issue of our new monthly SCIENTIFIC AMERICAN. This he has done, and it is particularly opportune at this time, when electrical transmission is a subject of such general discussion, that we should hear from a man who has seen the distribution of electricity grow from the 110-volt and 220-volt of the first Edison power plants to the 220,000-volt transmission lines of the Southern California Edison Company, and who, furthermore, has the vision to predict what we may look forward to with certainty in the future.

Deep Water to Long Island Sound

THE report of the Federal Commission which is investigating the question of further increase in channel depths in our leading seaport will be awaited with keen interest, not merely in this city and in its own hinterland, but in all the States which make use of the port of New York. We have frequently referred to the severe handicap to trade imposed by the undeveloped dock system and the antiquated methods of distribution by barge and lighter. To these disadvantages must be added those arising from the lack of deep-water channels in various sections of the harbor.

Work is under way, and has been for some years past, on this improvement. Some of it has been completed, notably that magnificent man-made waterway, the Ambrose Channel, two thousand feet in width and forty feet deep, which extends, unbroken, for seven miles from The Narrows to the Sea. Full forty feet of depth should be the ultimate aim in all the future work of deepening, that which is in progress and what is planned for the future. Newark Bay should have such a channel, and Jamaica Bay also; for at the rate this city is growing industrially, there will be a demand at both centers for channel accommodation for the largest freighters to lie at their docks. And the demand will come rather sooner than later, for such is the lesson of all transportation problems, whether for passenger or freight, whether by land or sea.

This port, by virtue of its geographical position, is today, and must ever remain, the chief port of entry and departure for that great stream of traffic which flows in ever-increasing volume (save in times of universal depression) between the Old and the New World, and between our republic and those of South America. The present era is the most important in the history of this port; for within the past few years there have been opened three waterways which will have a profound influence upon the growth of traffic at New York. In this order of importance these are the Panama Canal, the State Barge Canal and the Cape Cod Canal. The first undoubtedly places New York in a more favorable relation to the seaborne traffic of the world; the second will develop a broad belt of country rich in agriculture and industry, and will afford a more economical outlet for the traffic of the Great Lakes; the third should stimulate trade with the ports on our northern seaboard.

There is a final argument in favor of deepening the East River, which, from the Federal point of view, is perhaps the strongest of all. We refer to the fact that the leading navy yard of the United States is situated on the East River, and that, by providing forty feet of depth from the yard to the Sound, our ships will be in the unique position of having two deep-water approaches from the Sea, the entrances to which are over 100 miles apart. This means that a blockading fleet would have to be split in two, one-half being placed at each entrance, whereas we could attack with our whole strength at Montauk or at New York.

Electricity

Electrical Fixation of Nitrogen. — The usual electrical methods for the fixation of nitrogen are classed as follows: (1) The production of nitric acid and other nitrates by oxidation of atmospheric nitrogen in the electric arc; (2) the synthesis of ammonia from nitrogen and hydrogen through the action of a catalyst in an electrically heated furnace; (3) the high temperature production of the nitrides of certain metallic elements; (4) the production of cyanamides and cyanides. These methods are discussed in detail and figures are also given in a publication of the British Electrical and Allied Manufacturers' Association.

A Special Advantage of Electric Traction is the great certainty and economy with which time-table speeds can be worked to and lost time can be made up. With steam locomotives scheduled working is largely dependent on the quality of the coal, especially in hilly districts; while it is both difficult and costly to make up lost time. Owing to the great energy demanded by heavy trains, new regulations, particularly for mountain services, are often necessary in electrifications, in order to obtain a rational ratio peak load to average load, and care must be taken to prevent too many trains ascending gradients simultaneously.

Largest Generator Built.—A 60,000 kva. 7000-volt, three-phase generator, rated at 1000 r.p.m., but designed to withstand 50 per cent increase in speed, has been completed by the Siemens-Schuckert Works in Germany, according to *Electrical World*. The largest rating provided in any generator previously built by this company was 21,500 kva. so that this order represented a big jump beyond all experience. The ability to withstand such overspeeding was also a severe requirement owing to the utter lack of high-grade nickel steel at the time the unit was ordered. Owing to the size of the generator, special cars had to be built for the rotor and stator. The rotor gondola car had two ten-wheel trucks.

The Trackless Trolley Abroad. — From a German periodical, *Elektrotechnische und Maschinenbau*, we learn that electrically-driven buses connect Vienna with a suburb a short distance away. These trackless trolleys run on pneumatic tires and are fed from a double trolley line on which rolls a small contact-making carriage, connected with a flexible cable to the car. The length of this cable can be varied, as its end is wound around a take-up drum. Approaching cars have to stop when passing each other, exchange their cables and proceed again. The cars are driven by two motors, built into the rear wheels. They are multipolar, slow-speed, direct current 550-volt motors, transmitting their power directly without any gears. The buses accommodate 24 passengers, but can carry as many as 40.

Steel Transmission Towers. — The increasing demands for electric power in every section of the world call for longer and higher transmission lines and greater voltages. The adoption of 110,000, 150,000, 165,000 and 220,000 volts as desirable for main transmission lines has introduced new problems in transmission tower steel. One important factor is ductility, combined with high elasticity, as the continued vibration in long spans caused by wind puts a heavy strain on the transmission towers. Crystalization is less likely to occur if the steel has great ductility and high elasticity. One manufacturer of open hearth steel for transmission towers claims a minimum elongation of 22 per cent for his towers, an elastic limit of 45,000 pounds per square inch, and a bend of 180 degrees flat without cracking. Steel with these specifications has been found suitable for the record transmission lines of the West and will meet the requirements of any location.

Again, Electric Water Heaters.—There appears to be some misconception regarding the use of electricity for heating a water supply. Many persons, contemplating electricity for obtaining hot water supply, labor under the erroneous impression that such an installation calls for only a few amperes of current, and then only when the water is actually to be drawn. As a matter of fact the usual water heaters, which connect directly to the water pipe at the point where the water is to be drawn, require anywhere from 20 to 50 amperes. The all-faucet types, which serve to heat water for an entire plumbing system when wanted, draw anywhere from 50 to 70 amperes at 220 volts, and 80 amperes on 110 volts. It must be remembered, however, that these are instantaneous heaters, which means that an enormous localized heat is required. Were it possible to heat a similar quantity of water, say, in an hour or two, a relatively small amount of current would be required.

Science

Saved by Swollen Grain.—The steamer "Seapool" struck an iceberg off Newfoundland and began to fill. The swelling of the grain in her forehold stopped the hole and prevented her from sinking.

The Leaning Buddha is a Chinese rival of the tower of Pisa. This twelth-century pagoda, near Nanking, is 100 feet high, of 13 stories, and inclines 12 feet from the perpendicular, while the 179-foot leaning tower of Pisa inclines 16½ feet.

A Statue of Herod the Great. — Excavations conducted by the British School of Archaeology have uncovered and identified the cloister around the famed court of Herod the Great, the magnificence of which was described by Josephus. These ruins of Ascalon reveal statues of the gods, and a gigantic statue of Herod the Great himself has just been found there.

Tarred Roads Menace Fish Life.—The pink worms found in the mud-scrapings from country roads make excellent trout bait; but the carbolic acid from road tar kills them—and the trout too. Experiments prove that the spermatozoa of fish are destroyed by the carbolic acid from tar even when the quantity is so minute as to be almost undetectable.

New Use for Soda-Water Bottles.—One means employed in studying the growth and distribution of fishes is to set afloat both empty and weighted soda-water bottles to determine surface and bottom currents. In 1920 the Fishery Board of Scotland released 2400 bottles for this purpose and recovered, during the same year, 290 of them.

How Elephants Play. — The Cape Colony elephant reserve, says the *Christian Science Monitor*, affords fine facilities for the observation of pachydermatous behavior. The huge beasts often amuse themselves by squatting on their haunches at the top of a steep bank and coasting down to the pond at the bottom. Baby elephants that evince fear are coaxed to the crown of the hill and shoved off.

Humidity, the Misunderstood.—The layman uses the term "humidity" as a convenient summer cuss-word; even the scientist has no very exact way of determining the relative proportions of heat and moisture in the air. We do know that a healthful percentage of humidity along our coasts is 50 to 75; a higher percentage benefits plant life but brings discomfort to man. During high humidity electricity is stored by the atmosphere, and our body supply is depleted.

The Home of Heads and Horns.—R. L. Ditmars, of the New York Zoological Park, is preparing a motion picture that puts the trick film into educational use. It will show the construction of the new Museum Building that is to house the National Collection of Heads and Horns. The picture begins with the clearing of the forest; eight-second intervals represent a week's progress in building, and the end of the film will show the arrangement of specimens upon the walls.

Bear Island's History. — Midway between Norway and Spitzbergen, Bear Island thrusts its head, known as Mount Misery, above the cold waters. The whole island, save for moss and lichens, is almost destitute of vegetation. Long ago it was joined with the Spitzbergen archipelago; the continental shelf upon which the island sits shows a drowned valley deepening to 200 fathoms; this marks the course of an ancient river system that must have drained an area larger than the present basin of the Volga.

Concerning the Late John Daniel.—Experts of the American Museum of Natural History are studying the remains of "John Daniel," the gorilla that died while with Ringling Brothers. Body and brain are being dissected by specialists, casts of the head and face have been made, "finger prints" have been taken, and interesting facts pointing to "John" as a distant relative of man have already been disclosed. Later the public will no doubt see him, life-like but motionless, in the hall of primates of the Museum.

Finger Prints and Old Masters.—Two canvases entitled "The Virgin of the Rocks," one in the Louvre, the other in the National Gallery, London, have been attributed to Leonardo da Vinci. Scotland Yard was called in to decide the vexed question of authorship. Leonardo, like Titian, used his fingers freely in laying on paint—flesh and glazings are particularly amenable to this method; under a good glass the whorls of finger and thumb were well-defined on both canvasses, and were found to be identical on both. This is a triumph for those critics who declared both canvases to be the work of Leonardo, and a corresponding defeat to those holding that the London replica, while it might have been executed in his studio, was the work of a pupil.

Astronomy

Origin of Lunar Features. — Mr. Walter Goodacre, discussing the photographs of the moon taken at Mount Wilson with the Hooker telescope, says that the hypothesis ascribing the formation of lunar craters to the impact of meteors is now generally discredited, but if additional arguments against it were necessary they would be found in a careful study of the superb photographs above mentioned. He states that a consideration of the fine detail found in these pictures, especially in relation to the many crater chains and clefts, suggests that their existence can only be accounted for on the supposition that they are due to volcanic agency in the early days of the moon's history.

What Is a "New" Star?—Dr. Harlow Shapley, writing of novæ and variable stars, points out that at least two objects appear to be entitled to the name "new star" in a literal sense. These are stars which have increased in brightness from the unknown and do not fade away. One of them, RT Serpentis, has been of magnitude 11 for the last seven years, first appearing in 1909 as a star of magnitude 14. The other is 27, 1920, which, according to Wolf, appeared in 1908 and had reached the 11th magnitude in 1920. Eventually these two stars may fade away, or they may be stars slowly emerging from behind obscuring clouds, rather than objects newly born. Up to the present time, however, the name "new star" is more appropriate for them than for ordinary "novæ," so called.

Mt. Wilson Lunar Photographs.—The last report of the moon section of the British Astronomical Association dwells upon the many additions that have been made to the map of the moon by recent photographs taken with the great 100-inch reflector at Mount Wilson and suggests that a complete photographic atlas of the moon made by the same instrument would be a magnificent achievement. For example, one of the Mt. Wilson photographs depicts the whole of the Mare Imbrium. A rough count of the craters and craterlets shown in this region gives a total of more than 700, of which about 300 are not found on any existing maps. It would take an observer, using a powerful telescope, several years to detect and map all of these minute details, which have been recorded by the camera in less than two seconds!

A Great Catalogue of Double Stars.—As previously announced in this column, Dr. Robert G. Aitken is carrying out the work left unfinished by the late Professor Doolittle of bringing Burnham's "General Catalogue of Double Stars" up to date. The original work, at the time of its publication in 1906, was a practically complete record of every known double star within 121 degrees of the north pole of the sky. The discovery and measurement of doubles has made great progress since that time. The new work will contain records of some 20,000 stars and will not be ready for the printer for at least three years. Meanwhile, Dr. Aitken is in a position to offer lists of stars specially worth remeasuring to any observers who wish to cooperate in making the catalogue as valuable as possible.

A Novelty in Astronomical Publications is a circular of the Observatory of Cracow, mentioned in the *Journal of the B.A.A.* The language of the circular, "*latino sine flexione*," was devised by Prof. G. Peano, of Turin, on lines suggested by Leibnitz. The words are mostly Latin, without grammatical inflection, and the whole can be easily read by anybody with an ordinary school knowledge of Latin and a smattering of French. Here is a specimen sentence: "*Observatorios et astronomos, qui non mitte etiam ad nos suo publicationes, es precato to pone Observatorio Astronomico de Crecovia (Polonia) in lista de correspondentes.*" Meaning "Observatories and astronomers who do not at present send us their publications, are asked to place the *Astronomical Observatory of Cracow* (Poland) on their list of exchanges."

A Star Larger Than Betelgeuse. — The enormous size of Betelgeuse, as revealed by interferometer measurements at Mount Wilson, was a topic of widespread popular interest a few months ago. News now comes from the same observatory that Antares, the well-known first-magnitude star in the Scorpion, is probably even bigger. Its angular diameter, as measured with the interferometer, comes out 0.039 second, thus greatly exceeding Russell's predicted value of 0.028 second. There is some question as to the parallax. If it is assumed that Antares belongs to the Scorpion group, the resulting value of the parallax is 0.0085 sec., and the diameter 430,000,000 miles. If, however, we give the same weight to this value and to the mean of the measured parallaxes, we find 0.013 sec., and a diameter of 280,000,000 miles. Either value is greater than that obtained for Betelgeuse; viz., 218,000,000 miles.

Death Valley Transportation

How the Borax is Transported from This Hottest of Regions to the Nearest Rail Connection

By John L. Von Blon

UNIQUE in the beginning, long ago, and so remaining to the present, transportation methods in Death Valley yet have undergone the processes of a most interesting evolution. This statement applies more particularly to the changes wrought in the hauling of the output of the forbidding California sink's one great industry—borax production. Fifty, forty and as recent as twenty years since, the means of transport to the world without—for Death Valley was an infernal region apart—consisted of the "twenty-mule" teams that brought fame to themselves and the mysterious desert pit. The full story of the romance and the tragedy that attended these indomitable commercial caravans through the hottest spot on the globe never can be written. Swirling sands blotted it out from day to day. But these simple carriers made good. The creaking wagons and the plodding mules proved themselves extraordinarily efficient in making delivery many weary miles over burning alkali waste to the nearest rail shipping point, and aided materially in the making of a world civilization. If "cleanliness is next to godliness" they were a boon to humanity; for the cleansing agency they made available polished more than one continent. Still, the hardships, the downright misery suffered by beasts and drivers, are beyond the comprehension of dwellers in blessed places of brooks and shade and tempered breezes. As a rule the animals lasted but a short time. A large proportion of the teamsters, however, once inured to the life, jogged forth and back through the blinding white dust for years and years, and for most of them it became a shroud after the race was run. To live in the weird silence, gray and sombre, between the Funeral Range and the Panamints, is to die there. The "desert rat" does not leave because he cannot be content elsewhere. A few of the old-time drivers survive. The climate has the virtue of being exceedingly healthful for those who can stand it.

Automobile equipped with flanged wheels in daily operation, carrying mail and passengers, over the 20 miles of the Death Valley Railroad, between Ryan and the borax mines

The tugging strings of mule flesh drew their unwieldy loads on wretched trails, ever changing—the deep gashes cut in hideous hills by cloudburst, the rough wash and the treacherous salt marsh, where bottom is an uncertainty. In one place more than thirty years ago an eight-mile stretch of road six feet wide was built across a solid reach of salt and graded exclusively with sledge hammers. The action of heat and moisture from below had forced up salt pinnacles hard as rock, two or three feet high and countless, and these had to be hammered down. This road is unlike any other. It facilitated hauling but it was cruel to hoofs. Sloping down to this salt artery are several wide fields of crude borax—borate of soda. The main and better deposits are higher up, which was a factor of consequence to the four-legged "locomotives." The "team" consisted of sixteen to twenty-two animals, dependent upon season and conditions. The leaders, it will be observed by reference to the illustration, were horses. This was because these proved steadier and more intelligent in responding to the directions jerked from the driver's seat at the rear of the long dust-laden column.

When progress demanded more expeditious service mules were superseded by steam, a slow but sure heavy tractor of the upright type drawing laden trailers to railhead. The Piute Indians, Arabs of Inyo, called this contrivance "fire devil" and for months they wouldn't venture within a hundred yards of the smoking, hissing monster. In the more torrid season the crews suffered terribly, and a man on one of the wagons died with a canteen of water in his hand. The accompanying photograph was taken in the winter, when ice frequently forms. In front of the boiler a cold-water tank was ingeniously anchored on the tractor. The water in it never was long cold. In a few hours it would become so heated from the sun's intense rays that it had to be uncovered. Frequently it was pumped into the boiler practically at the steam-producing stage. Here probably is the one spot on the globe where it would be possible to install a steam-power plant and operate it with little artificial heat. The temperature is furnace-like. Death Valley's maximum of 160 degrees Fahrenheit never has been equalled elsewhere. In the summer 140 is common, and at midnight the mercury hovers at 120. So hot does the earth become in August that a rock or a bit of iron scorches the naked hand like a live coal. No wonder water boils in the sun! There was nothing pleasant about handling that tractor.

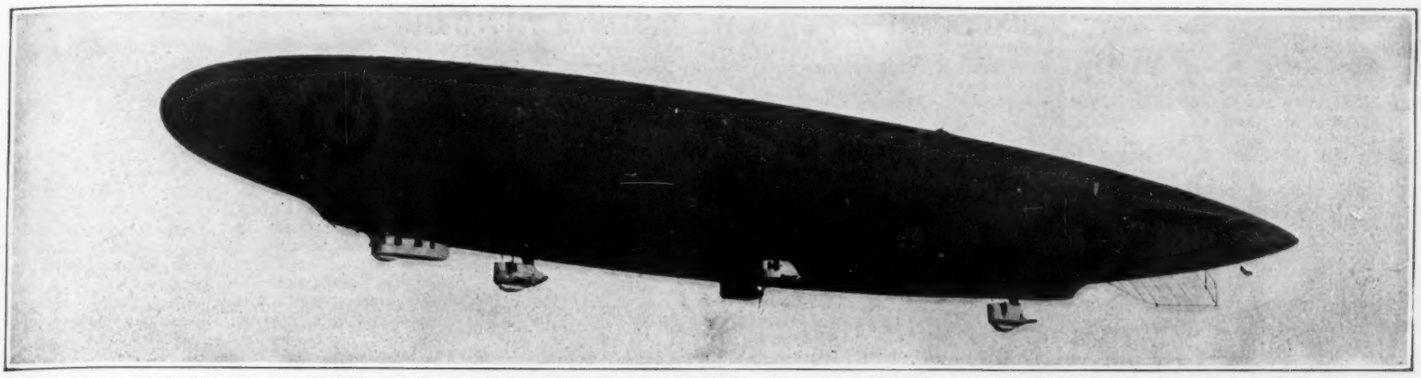
Now the Death Valley railroad, itself a borax enterprise, reaches outside connections with mineral trains, linking the principal mines with the station of Ryan. This is a trackage of twenty miles and here again an unusual vehicle is in operation. This is an old automobile equipped with flanged wheels and it carries the mail daily between the two points, handling also occasional passengers and making surprisingly good time. Because of frequent violent gales, hot as blasts of flame, a stop is out of the question but riding is made tolerable by speeding up. Sometimes on a trestle a whiff of cool air is encountered. Occasionally the machine is blown off the rails.

At the mines, where the landscape ever looks like a snowfield but doesn't feel at all that way, gasoline motors are employed for borax and other hauling.

The Temperature at Which Fish Thrive

EXPERIMENTS recently made abroad by M. P. Audigé as to the temperature best suited to fish, show that this varies markedly according to the nature of the fish. In the case of those qsh which are classified as eurythermic when subjected to a constant temperature of 14 or 15 deg. Cent., they do not grow as well as the parent fish which have been subjected to the ordinary seasonal variations of temperature. But when the offspring are kept at a constant temperature of 20 or 21 deg. Cent., on the other hand, they grow much faster, and faster still at 24 or 25 deg. Cent., so that by the time they have reached their fourth year they are twice as large as fish living naturally.

Left: The famous "twenty-mule" team of twenty years ago. *Right:* This steam tractor train superseded the mule wagons. Note the improvised water tank ingeniously anchored in front of the boiler



General view of the German non-rigid Parseval type airship "PL-27" in actual flight. Capacity: 1,000,000 cu. ft. Length: 518 feet. Diameter: 64.3 feet. Useful load: 39,600 pounds. Total horsepower: 960. Speed, 72 miles per hour

Getting a Line on the Higher Atmospheres

By S. R. Winters

WHEN Prof. R. H. Goddard of Clark University details his exploring rocket on its extreme sky-climbing errand—probably in the vicinity of the moon—a weather-recording device recently designed by S. F. Fergusson, meteorologist of the United States Weather Bureau, may serve as a companion instrument in revealing atmospheric conditions at excessive altitudes. The new meteorograph—weighing approximately six ounces—is the lightest apparatus of the kind ever built. With its protecting basket and a parachute, ready for ascension, the weather-recorder weighs slightly more than nine ounces, while a meteorograph designed by a Frenchman in 1904—heretofore a claimant for the distinction of extreme lightness—weighs about two pounds, including the basket and parachute.

The Fergusson invention, although having features which recommend it as a possible companion instrument of the Goddard exploring rocket, is of primary service as an accompaniment of balloons for faithfully registering by an intelligible method temperature, moisture, pressure, and wind velocity miles above the earth's surface. Heretofore the excessive cost of the rubber balloons employed in carrying aloft the heavier type of weather-recording instruments has factored in its use as an ally in weather prophecy—obviously, a limiting factor. The new aerological apparatus can be lifted by one or two small pilot balloons, the cost of these being barely one-tenth as much as the balloons now detailed for exploration of the upper atmosphere. Then, too, if we are to accept an authoritative claim, the pilot balloon is of superior quality, a virtue, when coupled with the light meteorograph, vouchsafing the attainment of greater heights for information upon which to base the forecast. "Fair and Warmer Tomorrow."

The Fergusson progeny, which has qualified for service by rigid laboratory tests, aims to overcome weaknesses inherent in its predecessors. The defects of previous designs are thus summarized: The instruments are complex, the parts are hand-made and do not lend themselves to repair in the absence of a skilled instrument maker and are not adapted to quantity production; the fixedness of the supports is ordinarily secured by use of thick base plates and bases attached to a pivoted device, thus not insuring permanency; the commercial clocks used operate 30 hours at a single winding, and the time-drum rotates once in an hour—an inharmonious arrangement inasmuch as an ascension seldom requires more than three hours—indicating that a portion of the records is frequently obscured or lost because of tracings of surface conditions after the instrument descends and before the clock suspends operation; the number of operations entailed when the device is prepared for flight in measuring and reading the records is unnecessarily large.

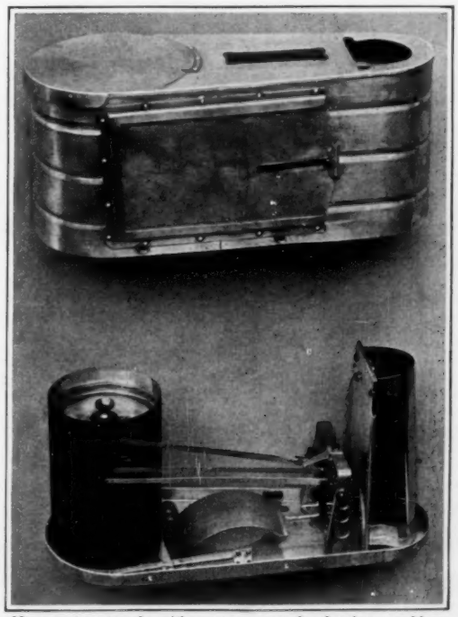
The clock, the heaviest integral part of a light weather-recording instrument, was subjected to modifications in the interest of lightness and cheapness of production. The movement employed, a massed formation of parts selected from a series of American clocks, partakes of the general character of the Ingersoll watch. The improvised unit is stronger, however, and the teeth of the pinions are severed. The quality of the clockwork is more variable than desired, but the movement is a reliable timekeeper and can be employed economically. The fault of other instruments in tracing surface conditions after the meteorograph has returned to earth has been remedied in the recent design. The clock has its main spring on the center staff, or minute-hand arbor, to which the time drum is clamped. Here a tiny watch spring is of sufficient power, and the number of rotations of the drum (less than seven) can be restricted as desired by winding the spring the requisite number of turns.

The temperature element, or the mechanism for charting the degree of heat or cold, is described as extremely sensitive and more powerful than record strips incorporated in similar instruments. The strip of "thermostatic metal"—made of closely-embracing sheets of invar and bronze—is only 0.2 of a millimeter (one millimeter is about .04 of an inch) thick.

The outstanding feature of the barographic portion of the weather-recorder is its variable scale, whereby minor changes of pressure at altitudes above 32,800 feet—exceeding the air-soaring record of Major R. W. Schroeder of the United States Army Air Service—can be read with greater accuracy than is possible with a uniform scale. The ratio of the scale of a barograph to that of the mercurial barometer is 1 to 10; that is, one millimeter of movement of the pen of a barograph at sea level is equal to a pressure change represented by ten millimeters of mercury. But the record sheets of the barograph cannot be relied upon within .1 millimeter of space traversed, and thus, in the reading of heights exceeding 30,000 meters, an error in excess of 2000 meters may occur. The variable scale of the new meteorograph, according to the claims of the designer, eliminates this source of error.

The humidity element consists of six or eight strands, each composed of three fine hairs—these being sheltered from the heat of the sun. The tension of these hair-like strands is maintained by a flat spring, the outer

(Continued on page 243)



New meteorograph with cover removed, showing working mechanism. The clock-driven drum at left may be lifted out through top of cover, while the marking pointers, pivoted and actuated at the right, are accessible through the sliding door on the side

Meteorograph developed by the Bureau of Standards

The Parseval Semi-Rigid Airship "PL-27"

By Ralph Howard

THE development of the German non-rigid PL airships occurred between 1906 and 1917. These two letters stand for "Parseval Luftshiff." The Parseval airships are all built according to the patents of Major August von Parseval, Dr.-Engineer, by the Luft Fahrzeug Gesellshaft (L.F.G.) at Berlin and Bitterfeld. That the Parseval airships were successful is attested by the fact that they were used before the war in Austria, England, Italy, Russia, and Japan.

Since 1913 all Parseval airships were constructed with envelopes having the Parseval patent trajectory band system of car suspension, which is a very efficient system of non-rigid construction. The "PL-27," built during 1916, is in reality a semi-non-rigid airship, although classified in Germany as a non-rigid one. Within the envelope of this ship there is a V-shaped keel extending almost the entire length of the aircraft and containing the narrow runway or "catswalk" common to all large airships of the Zeppelin or rigid type. Forward, beneath this, is the navigating car or gondola, while immediately behind it is the first power car in a central position. In the center of the dirigible, on each side of the keel, are two power "eggs" or cars similar to those used on the later types of Zeppelins. At almost the extreme aft end of the keel is located another power car. All of the power cars are carefully streamlined. The gasoline tanks and water ballast bags are located on each side of the runway, the same as in rigid airships. "PL-27" is the largest "semi-non-rigid" airship built to date, and her performances have been extremely good, especially as regards useful load and speed. Nothing has heretofore been published about the carefully-guarded development of this type of ship that took place in Germany during the late war.

The interesting and important main dimensions, weights, performances, etc., are as follows:

Capacity, 1,000,000 cubic feet; length over all, 518 feet; diameter, 64.3 feet; total load, 74,700 pounds; useful load, 39,600 pounds; number of engines, 4; make of engines, Maybach; total horsepower, 960; propellers, 4 two-bladed of wood; speed, 72 miles per hour.

The photograph gives an idea of the complexity of a non-rigid airship of such dimensions. It has the advantage, however, of not being so liable to break its back, or certain girders thereof, as happened in the case of the "ZR-2," with such unfortunate results. If, instead of prohibiting experimentation of any sort with airships by Germany in the Versailles Treaty, the United States had allowed construction and experiments to continue to a certain limited extent, she would undoubtedly have benefited thereby in her new policy of aircraft construction, as proper tests of "PL-27" would probably show her to be superior to the Zeppelins as regards economy and useful weight lifted, although at present the latter type of airship is considered in Germany to be better for long-distance transportation.

The above photograph, at first glance, might be taken for one of a Zeppelin. Close study reveals the points of difference, however.

Curing Leprosy with Antimony

IT is reported by a British investigator, Mr. F. G. Cawston, who has been studying leprosy at Durban, that the administration of colloidal antimony appears to produce good effects. According to the *British Medical Journal* he found that lepers in an advanced state of the disease, with all of their fingers and toes suppurating, were helped to such an extent by this treatment that the suppuration entirely ceased.

Needed—A New Army Uniform

An Argument and a Suggestion Regarding a Change in Our Doughboy's Outfit

By E. C. Crossman

FROM the physiological effect the uniform must have been designed by some person interested in seeing what constant coddling of the chest and throat would do to the human race. Normally the chest is hot and perspiring in this sort of a coat. Not only is the coat buttoned to the top of the chest, but there is a standing collar, further to prevent the entrance of any air. To throw the coat open after wearing it a while is to test the resistance of the subject to sudden chilling and colds.

In hot weather the Army coat is a beautifully adapted sweat box. If you then seize the unfortunate military person in a firm grasp and wrap his nether limbs in leather leggins, or those of the cloth, wind-around variety, so that no air can possibly strike his ankles and aid in keeping the body temperature down, you have a combination that cannot be surpassed for gilt-edged asininity.

Covering up the chest and throat in all sorts of weather does not protect the wearer; it merely encourages troubles of the chest and lungs. Physicians assure us that, with their lighter clothing, women take cold less easily than the men, are less subject to pneumonia and other pulmonary troubles, and in general tweak old Borens's whiskers and suffer but little for their contempt.

Now that war is recognized to be a gigantic, wasteful, inefficient, crude, gory and engineering job, romantic as digging a canal and with the means for your taking off probably developed in a chemical laboratory instead of being the flashing sword, this uniform nonsense is about played out. It has no place in modern warfare except to distinguish those of one side from those of the other and to show who are active fighting men and who are not.

War is a job of mighty hard work, nine parts walking to one of fighting, a hundred parts carrying things to one part shooting. A brass band and pretty ribbons and a choker collar and a flat back and a pair of boots with spurs on them have as much to do with the grim job of digging a trench, and then clambering out of it, later, to the rattling of engineering tools called machine guns, as they have to do with an air-lock under the Hudson River.

Our present examples of uniforms don't even possess the merit of neatness, as worn by the enlisted men. The cloth used is something like the stuff of which Teddy Bears are made, a nice woolly material that defies any attempt to make it lie in smooth surfaces. The collars fit just about as often as you would expect a collar to fit, when you picked one out by the soldier's chest measurement or his foot measurement or some other extraneous consideration. They are a dejected sort of a collar, too, and don't stand up like the collar of the officer's blouse or coat. The type of coat with stand-up collar emphasizes any lack of fit, which the lapel type of coat might conceal, and all in all, the average enlisted man of the present army, in spite of the pathetic attempt at a "military" effect of his coat, looks more like a misfit than a soldier, or the self-respecting youth that he is.

Here and there some more than usually self-respecting chap rebels and spends his hard-earned cash in a made-to-order uniform of serge. This done, being still sensible, when there is neither M.P. nor officer around, he unbuttons his coat and gives his chest a chance for a nice long breath, so the effect of the high, Prussian stiff-necked, chin-chucking, enemy-scaring collar is largely lost. On a hot day, which is not unusual on this North American continent in the summer time, the only chance the soldier has to be comfortable with the present coat is to do without it. The British abandoned their stiff-necked uniform years ago—and they are alleged to be a people slow to move. If so, then our own retention of the Prussian uniform may be easily characterized—it is slower than slow.

Two advantages are urged for the present American army blouse and both are futile ones. One of them is that it is typically American and lets the American and the British soldier be told apart. The other, with a grain more sense to it, is that in cold and inclement weather in actual fighting the American coat better protects chest and neck. The British are said to have had to issue mufflers in France.

The reply to the first is that this country is not at present so over-run with British troops that there is likely to be much confusion. To the second argument the reply is just as easy. Any tailor can design a coat with lapels to turn up and button across, which would afford all the protection in the event of going into action during cold weather, now given by the American type of blouse.

The present uniform has additional pieces of cloth sewed on here and there, the top left unsewed and fastened with a button. These patches are dignified by the term pocket. They were copied after the British with the minor difference that the British pocket is a pocket and is made to carry things. It is the difference between a real street and one painted on the back drop. They look the same but one of them is for show alone.

All the comforts of home! Note the soldier on the right, and the one on the left. The chap on the left merely has his blouse collar folded down; if it were made that way it would look better than the other

What is urgently needed, therefore, are these few things:

1. A coat cut with turn-down lapels after the fashion of the British blouse, to permit air to reach and leave the chest regions, and to afford the neck free and uncramped movement.

2. Pockets made with some form of pleats or "bellows" which would permit, if necessary, some few personal accessories to be carried without putting humps and bulges all over the son of Mars' form.

3. Long trousers as articles of regular issue, not special, with the abominable leggin and its leg swathing, sweating, varicose-vein producing pressure, and the knee cutting, tight breeches, used only for field work, and left off when this kind of activity is over.

A change in the color of the uniform is urgently needed for more than one reason. Now that the war is over, and surplus stocks have leaked out through sales to private stores, and every discharged soldier took home and kept his uniform, we find it, either in full or in part, on truck drivers, garbage collectors, chauffeurs, elevator men and beggars. The very color is an abomination to a weary people. Futile and emasculated, and quite obviously unenforceable laws have been passed by legislatures and Congress, and passed just as promptly into innocuous desuetude, these providing for dire penalties for mis-use of the uniform or parts thereof. The country is full of nut-brown shirts, pants and even coats to which the wearers have good title and cannot be deprived of.

The color itself is most hideous, and inferior to others for war. The Marine Corps have a far better color for concealment in the field, a darker brown with a green tinge to it. Tried in various lights and against various backgrounds, it has proved superior to the Army shade, just as did the green-gray of the German. The Army shade is no shade, the uniform ranges from a dirty mustard through every variation of brown or tan known to chemistry, and some impossible to reproduce.

Wherefore with gentle peace descended over the scene, with Congress having taken one good swing at the Army and chopped it from 280,000 to 150,000 and just getting its second wind, it is now a fine time to detail a few hundred officers on the job of considering a sane and sensible uniform in cut and color for that aggregation of engineer specialists we keep on hand under the name of Regular Army. When their purpose is analyzed and the realization is reached that they are merely to engage in hard, dirty, unromantic engineer operations leading to destruction of an opposing body of men also thus engaged, by the use of modern scientific apparatus, then will the old notion of military pomp be dropped, and a uniform considered with the cold, critical eye of efficiency.

Utility of Reatomizing Devices

THE grade of gasoline sold today is extremely difficult to vaporize completely, and even when the vapor has been made it is easily condensed by striking obstacles to its free passage. The butterfly valve used in all carburetors, when only partly opened presents such an obstacle. As the vapor strikes this butterfly valve, the larger portion of it is condensed and thrown against one wall of the carburetor and some passes up the wall of the manifold in a liquid form and cannot be equally divided between the various cylinders.

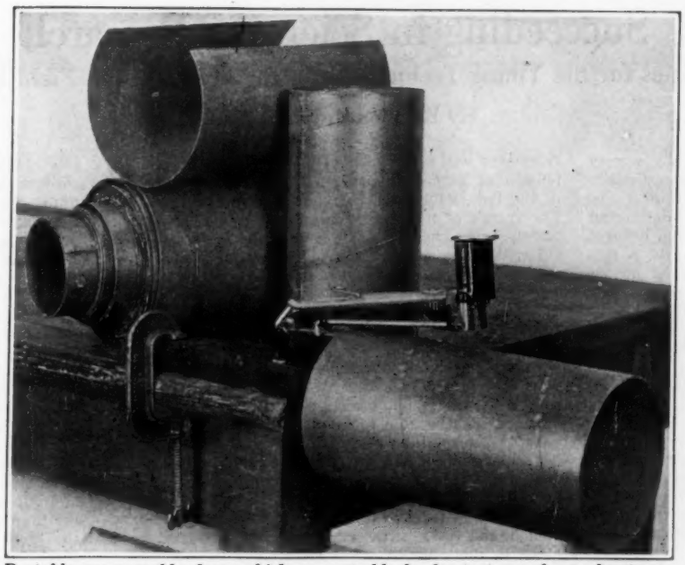
To meet this, a well-known carburetor manufacturer announces a "reatomizer," a device recently invented by F. O. Ball, which is placed between the carburetor and the manifold. It comprises a spacer into which is pressed a venturi throat carrying four small tubes. The spacer contains a passageway of the same diameter as the intake manifold. Around the lower outside edge of the reatomizer is a groove or annulus which forms a small circular chamber between the inside of the spacer and the outside of the reatomizer. The ejector effect of air flowing past a tube extending into the air stream in the direction of flow of air is very well known. This principle is the basic idea of this reatomizer. The ejector effect on the four tubes which extend into the throat tends to draw into the annulus any liquid gasoline which may be passing up the wall of the carburetor and to eject it from the tubes in an atomized condition so that it floats in the air stream and goes equally to the different cylinders.

It is claimed that this simple but sure reatomization of the gasoline makes it possible to adjust the carburetor for a much leaner mixture, thus lowering the fuel consumption and reducing crankcase dilution.

Paper Molds for Concrete Test Blocks

WEIGHING only seven ounces, collapsible and portable, a paper mold for concrete test cylinders, as designed by the National Bureau of Standards, offers the novel advantages of being slit lengthwise and capable of being assembled at the job by lacing-up with a stapling machine. Its make-up permits nesting during shipment. Testing concrete in construction work and linking these tests with laboratory experiments and control is a problem confronting the engineer who may supervise the designing of concrete ships, buildings and roads.

The portable paper mold is a contribution that may assist in solving the problem, because of its simplicity and absence of bulk compared with the steel mold which weighs about 22 pounds. The mold is made of heavily water-proofed cardboard, and when nested for shipment 25 cylinders occupy slightly more bulk and weigh only half as much as one steel mold used in laboratory work. Twenty-five one-half-inch staples, situated at intervals of one-half inch, are employed in lacing the container along the slit. The stapling machine weighs less than five pounds.



Portable paper molds, from which concrete blocks for test may be made at any time "on the job"

Once used, paper molds are worthless, except when left on the cylinder as a protecting influence to the concrete in transit to the laboratory. Comparative tests with steel and paper molds failed to reveal any deterioration of strength by the use of the latter. There is an absence of paper caps for base and tops, a layer of cement paste in the bottom of the mold before pouring the concrete and another layer on top preserve the concrete from loss of water and dryness. Likewise these cement caps answer the purpose of supplying adequate bedding surfaces during the compression tests, provided they are ground smooth on a flat steel plate, sprinkled with carborundum. The Emergency Fleet Corporation of the United States Shipping Board use these paper molds in testing the product used in the pouring of concrete ships and barges.—By *S. R. Winters.*

How Moisture Content and Storage Affect the Strength of Boxes

OF two boxes made exactly alike from the same grade and thickness of lumber, one may stand ten times as much rough handling as the other, because of a difference in the moisture content of the lumber or a difference in subsequent conditions. Tests made at the Forest Products Laboratory, Madison, Wis., show that only when a box is to be used for a very short time immediately after manufacture is the proper seasoning of the lumber unimportant.

Within a week after manufacture a box made of green lumber suffers a marked reduction in strength. As the wood dries, the nails lose their grip. The fibers which are bent down along the nail shrink away from it in the direction of the end grain, the direction in which it was most firmly held, leaving the nail held only by two sides. Under such circumstances the weaving action during transportation alone will readily cause the nails to work loose and even come out of the box. Boxes made of green lumber at the laboratory and kept for a year in dry storage tested only about one-sixth as strong as similarly made boxes tested at the time of manufacture.

If a box is made of dry wood and then subjected to alternate wettings and dryings, through cold storage or exposure to weather, the nails will be loosened just the same as in green lumber. Boxes made up from dry lumber were kept for two weeks in damp storage and then for two weeks in dry storage. After this treatment the boxes withstood only one-tenth as much rough handling as those made of air dry lumber.

A box made of lumber in the proper moisture condition will stand ordinary storage without any appreciable loss in the holding power of the nails. The best results are, therefore, obtained when the lumber is seasoned in accordance with the atmospheric conditions which the box will encounter in service. If it is impossible to forecast conditions, it is advisable to use air-dry lumber containing 12 to 15 per cent moisture.

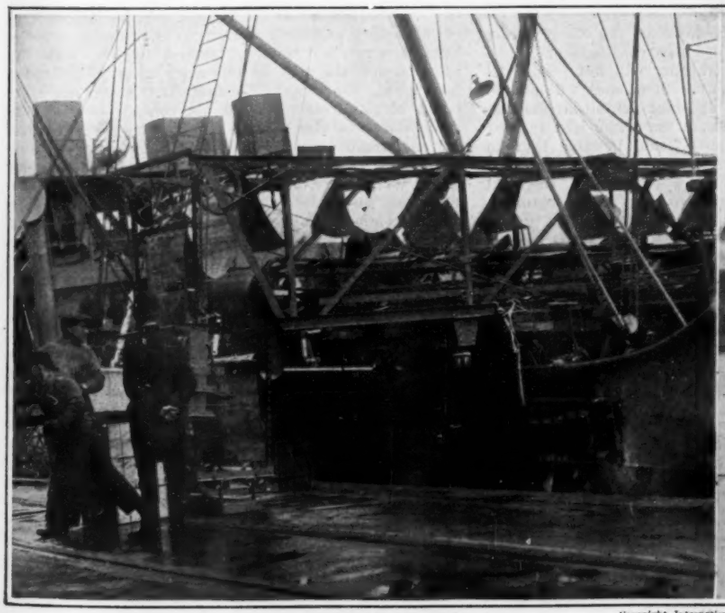
Package Conveyor for Loading and Unloading Ships

A GREAT deal of attention has been paid to loading and unloading machines for handling materials in large bulk, such as coal, ore, grain, etc., and the machinery for performing this work has been developed to a high state of efficiency, but hitherto not very much has been done to expedite the work of handling cargoes of small boxes or packages.

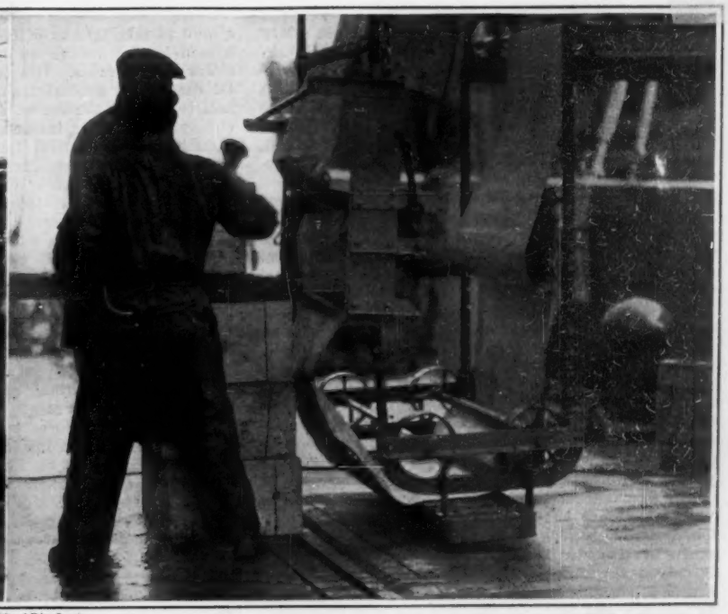
An ingenious canvas belt conveyor for this purpose is illustrated herewith. It is adapted to convey small boxes and packages of all shapes from the dock to the hold of the ship and vice versa. The conveyor consists primarily of a bridge or truss mounted on rollers so that it may be readily moved across the deck of the vessel with one end overhanging the dock. There are two parallel endless chains which are run over pulleys on the truss. At intervals the two chains are connected by means of bars or rungs. A canvas belt is attached to the rungs with enough slack between successive rungs to form pockets in which the material to be conveyed may be supported. At the outboard end of the truss the chains turn at right angles and are kept taut in this position by means of a carriage which hangs close to the floor of the dock. The chains may be adjusted for vessels of different height and for variations of the tide. Our illustrations show the machine in the act of unloading boxes from the ship. As the boxes come along in the canvas pockets, they are carried down off the end of the truss and enter a frame which is shown to better advantage in the picture on the right hand side. Here they are automatically tipped out so that they may readily be seized by dock hands and placed on a roller platform along which they are pushed to the point of delivery.

Further News About Static Electricity

AN Italian engineer, Mr. G. Lentner, is stated in a recent number of the *Bibliothèque Univérselle*, Lausanne, Switzerland, to have succeeded in utilizing atmospheric potential in the following manner: A post about 12 m. in height (and forming a sort of antenna) is erected. This post ends in a collector consisting of an aluminum sphere provided with points covered with radioactive substances. This collector communicates by a conducting wire with a special transformer. Under these conditions the earth current and atmospheric current attract each other through reciprocal induction. The radioactive substances exert an influence upon the transformer whose nature is not yet understood. At any rate the results are said to be very encouraging, so that the inventor expects to repeat his experiments upon a larger scale.



Canvas conveyor for loading and unloading ships



Enlarged view of the point where the conveyor delivers the boxes

Succeeding in Scientific Research

Opportunities for the Young Technicist in a Relatively Virgin Field of Endeavor

By Raymond Francis Yates

THE scientific research laboratory is today a very important part of every large industrial establishment. In fact, large industries cannot afford to be without research facilities and a highly trained staff of workers. The past twenty-five years have brought about very important and revolutionary changes in this respect. A tremendous field has been opened up for the imaginative, scientifically trained worker. Every day problems are solved behind the closed doors of the laboratory that will effect the destiny of mankind.

Dr. W. R. Whitney, Director of Research in the great laboratories of the General Electric Company, was kind enough to assist the writer in the preparation of this manuscript which is addressed to young men who believe they have some aptitude along this line of human endeavor. Dr. Whitney is certainly well qualified to give advice to young men who are interested in research work. The broadness of his experience and his unquestionable success in the direction of some of the most important researches that have ever been made enables him to impart advice that few men in the world are able to give.

No field of human endeavor is more fascinating than scientific research. There is more romance and adventure in a scientific laboratory than there is in the unexplored wilds of the Amazon. It is simply a different kind of exploration with a far greater chance of making a discovery. The research worker is always laboring on the borderline of the unknown; he is always confronted with mystery. At any moment he may make a discovery, just as the explorer in unknown lands may brush aside the bushes on a hill top or mountain side and gaze out over a new lake with gold-speckled shores glistening in the blistering sunlight. There is a peculiar lure in research—a subtle expectancy that may at any moment be satisfied with realization. This striking off into the depths of the unknown causes the blood to tingle and fills one's life with an insatiable desire to penetrate the blackness of the unknown.

When the writer asked Dr. Whitney what he thought the ambition of a research worker ought to be, he answered, "He should appreciate infinite possibilities." This is indeed a significant statement and one that should greatly interest a young man who contemplates entering this field. A man who realizes the infinite possibilities of research is in a good frame of mind to accomplish something. This is wholesome advice.

The average Research Engineer may command a salary of from three to five thousand dollars per year. There is no definite salary limit for a man of exceptional ability. Charles P. Steinmetz is a Research Engineer who is paid an enormously high salary and he is one of the foremost scientific investigators of this country. To say the least, the field of industrial and scientific research will give any conscientious worker a good livelihood.

When Dr. Whitney was asked if a man could succeed in Research Engineering without attending college he answered in the affirmative. A very complete training is necessary however, and the foundation of this training will be based on mathematics. The trained research worker, unless he is of the highly imaginative type, must have a good mathematical foundation to work with. Of course this knowledge can be obtained outside of college as well as the other scientific knowledge which the worker will have to assimilate. A man struggling to succeed in this field without taking advantage of the college curriculum should associate himself with a trained research worker in an industrial laboratory. The inspiration and help to be obtained in this way are of utmost value to say nothing of the advantage of working in a scientific atmosphere. Michael Farraday's association with Sir Humphrey Davy illustrates this point very effectively.

The demand for research engineers will always be with us. Today the demand is limited by the supply. There is a pressing need for highly trained imaginative workers in industrial research laboratories. It is only during the past twenty-five years that the research laboratory has been given a place of importance in industry and what development the next twenty-five years will bring is difficult to foresee. That the development will be extensive there is no doubt. The extension of human knowledge through the application of the industrial research laboratory is in its infancy. The future of no field of human endeavor could hold more promise than that of Research Engineering.

Dr. Whitney believes that a man should take a post graduate course of two years and a college course of four years if he desires to enter the profession as a first-rate research worker provided with all essentials for rapid development and success. This extensive college training will have to be supplemented with two or three years additional experience working with men who are trained in actual research methods. The research worker is not merely a cold storage for facts; he must also be able to manipulate and construct apparatus for special work. He has much to learn after he leaves college and he can only gain this by actual contact with problems and through association with men who have been "through the mill." Knowledge does not find its way to the finger tips without experience and very little experience of this nature is given in the colleges.

Research Engineering is a very broad field. It has to do with every phase of science. It is a field for the specialist, and every man setting out to train himself should choose some particular branch in which to specialize. For instance, we have chemical research work and this field may be divided up into a number of branches. Then there is the electrical field which may also be subdivided. Mathematical and mechanical research work are two branches of note. Of course, it will be understood that no college training will enable a man to take up any of these fields. In other words, a man leaving college as a Research Engineer is not a Jack-of-all-trades. His training will not permit it. Of course, his general training in science will enable him to enter a number of different fields that may be closely allied. For instance, a man who had trained himself along electrical lines would be able to take up any kind of electrical research work. However, such a man would be quite out of place in a chemical laboratory unless he decided to add to his training.

NOT so many years ago we were in the habit of marvelling at the efficient Germans, with their splendid research laboratories. In fact, many German concerns of even modest proportions were then maintaining research departments for the never-ending purpose of bettering their products and finding new ones. Today, after a lapse of a little more than a decade, we find the research department a feature of many of our leading concerns. Things are no longer done in a hit-and-miss manner. Instead, the failure of any given piece of apparatus or product must be pried into by the inquisitive research worker; better methods must be found in order to keep pace with market conditions; new products must be developed in order to meet the changing moods of a fickle public. The research laboratory has become an American institution, and a vast field of endeavor has been opened up for our young technicists. This is the story which Mr. Yates has to tell in this instalment of his series on success in divers technical fields.—THE EDITOR.

At this point the writer is going to take the liberty of quoting freely from an article written by Dr. Whitney which appeared in the *Electrical World* of June 17, 1920.

"We seem to have plenty of ambitious young men, plenty of schools, infinite distance to advance and countless directions, but our engineering students are seldom practiced beyond the "shoulder arms." There is such a gulf fixed between the receiving of information and [illegible] anything about it that Davy teachers and [illegible] students are unheard of."

Dr. Whitney believes that students should be encouraged to share in inspirational work instead of being subjected only to fact storage. Many college-trained research workers resemble a text-book on two legs when they step out of college. They lack imagination, initiative and practical working experience. The mere accumulation of facts, when carried beyond a certain limit, is apt to interfere with the imagination. Inventiveness depends upon imagination and every research worker must be an inventor. He must be able to invent ways of doing difficult things, producing new apparatus, etc. He must be able to imagine a certain result before he actually achieves it. In fact, his success depends greatly upon his imagination. The unimaginative, trained worker is only able to follow out the suggestions of others and he is destined to carry out routine work through his entire career. The creative urge in a research worker is an asset of great value.

Dr. Whitney went on to say: "We live in a period when the extent and the rate of increase in our mental horizon is maximum, when happiness has its grandest possibilities, and when human toil is everywhere being displaced and amplified by better latent energies. Never before was the individual and collective reward for new constructive effort so equitable. We are served by coal, oil, gas and water, with their countless accessories, better than ever before. Within a young man's lifetime we mined more iron, copper, coal and other ores, produced more kerosene, gas and gasoline, and put into use more of materials like cement and rubber than were produced by all the former inhabitants of the globe. And still the unfulfilled promises in Nature's books are greater than ever.

"Can we live up to this recent heritage? When we do many of the teachers of science will also be workers in science and better appreciated. *Engineering courses will prepare men to do new work where they now mainly create reverence for old.* It is easier to appreciate past developments than to extend appreciation to the unknown future, but, just as there is always more air for the trees as they grow upward, so is there more new knowledge as the existing branches spread. It is at the growing ends of engineering science that we ought to train our engineers.

"To the devotee scientific research may well become a religion, but whether he sees in the infinite possibilities of matter only the necessary results of permutation among seventy-odd decaying elements or the hand of an all-wise Creator ever uncovering new principles to hopeful investigators, he cannot be blind to the blessings of new truth. This is not produced to order. Conventions do not establish it. It comes only from following with interest Nature's devious and unexpected ways, studying apparently irrelevant phenomena, learning by experiment, regardless of aim. And since it is important to us that pioneer effort be individualistic, wanton, clean, but vagabond, it is this rare type of teacher whom we must support.

"Practice in doing and planning to do are part of good engineering training. This was the ground for the introduction of laboratory and field work into engineering schools. This develops our efferent system, which, with the afferent and the will, is necessary to a well-rounded individual. Our sports illustrate it. No college sport could be put over if it did not contain some of the same elements which make engineering so attractive. No one would play the game if it were always a copy or a repetition. If there were no feared defeat nor hoped-for victory, no new stresses applied, no new materials discovered and no return but gate receipts, there would be no real amateurs and no real sport. When this is applied to engineering proper it meets a perfect analogue. Few good engineers play for the gate receipts; they are led on by a will to accomplish.

"During the season the ball team and the trainers work over all the novelties they can collectively invent. Groups of engineers do this all the time. Now, with a picture before us of a lot of healthy young Americans about the training table discussing moves never tried before, take a look at the present engineering professor and his class. Overlook the fact that the training table might be a good start for all of them. Are they wondering what would be the result of some new move, or raising questions not answered in the books? Usually not, because that would interrupt the ordinary system of fact storage. The natural wish and the will to try the new thus gradually weakens under the pressure of endless records of others' trials. The efferent nerve atrophies from lack of exercise, while the afferent palsies in exhaustion.

"The heart of this note is the hope that we may realize that we must raise and support as teachers inquisitive searchers of Nature."

The Role of Chemistry

Visions of Future Progress of the Human Race Through Chemistry as Set Forth in Recent Addresses

By Albert A. Hopkins

THE meetings of the American Chemical Society and the Society of Chemical Industry were held at Columbia University and the College of the City of New York, these institutions lending themselves admirably to the necessity of minute subdivisions in sections. The meetings were preliminary to the great Seventh National Exposition of Chemical Industries which was held the week of September 12th in a large armory in the Bronx. One of the first matters discussed was the dye industry and resolutions were passed urging Congress to include in the permanent tariff bill a selective embargo for a limited period against the importation of synthetic organic chemicals and it was also resolved to urge upon the American delegates to the disarmament conference most serious consideration of the broad question of chemical armament as effected by the development and maintenance of the chemical industries in the various nations.

One of the first addresses and one of the most brilliant was by Sir William J. Pope, retiring President of the Society of Chemical Industry of Great Britain. It was entitled "Chemistry and Life." He declared for a chemical independence which would enable the development of material resources, especially in tropical lands, on lines not possible by methods originated in a self-contained European country. He elucidated the vital processes in the utilization of carbon dioxide by plants. He showed that the laboratory methods of organic chemistry have developed in a perfectly natural manner in such a way as to cause them to approximate more and more closely in kind to those employed in the plant. Sir William said: "It is safe to prophesy that the next great epoch of organic chemical progress lies in the very near future, and that it will lead us to laboratory methods of imitating with considerable fidelity the complex chemical changes brought about in living matter by the utilization of low potential energy."

If we believe this the logical conclusion to be drawn from our present state of knowledge and from the direction of development of method which has taken place during the acquisition of that knowledge, we must go further and foresee the advent of entirely revolutionary consequences which have wide bearings upon human affairs. The task of the chemical manufacturer has generally resolved itself into human labor and the use of coal, oil, water-power or other costly source of high potential energy, into finished materials marketable at an enhanced price which includes the cost of labor and energy. In only a few instances has the technologist been able to avail himself of the activities of the living organism in the manufacture of acid, glycerol, and acetone by fermentation, labor and fuel have generally to be introduced as costly auxiliaries. When we possess full working details concerning the plant-leaf process for converting carbon dioxide and water into formaldehyde and oxygen by utilizing the sun's energy, when we can make indigo and quinine by the identical methods adopted by the plant, chemical technology will be an entirely different proposition from the one which it now represents. Not that it is likely that we shall desire to replace the laboratory of the living organism as a source of natural products; it is difficult to believe that the indigo plant, properly developed and properly worked up, is not capable of competing successfully with coal-tar as a source of indigo. The elucidation and imitation of plant and animal chemical methods will, however, provide us with means for manufacturing vast numbers of products which are unknown in nature, because the lower creation has no need of them; we are nowadays so far from nature that many such products may be of the utmost value to modern civilization.

Considerations of the kind which have just been advanced force upon us yet other reflections. Fuels and other sources of high potential energy are becoming more scarce, human labor is becoming more costly, that is to say, is becoming less willing to expend itself; on all hands we are met by the demand and indeed by the expectation that science will lift the curse of Adam from humanity. It is no part of my task today to discuss philosophical questions which originated in the Garden of Eden, but it seems plain that modern science is called upon to find means for curtailing the expenditure of such high potential forms of energy as human labor and mineral. The solution of this problem must come from the proper utilization of the radiant energy which comes to us from the sun; we require efficient methods for transporting solar energy from the tropics for use in our more temperate climes. It is perfectly possible that the scientific study of oil-bearing plants in tropical regions may lead to such improvements in yield and cost of production that vegetable oils will replace the ordinary fuels, coal and petroleum, now used the whole world over.

Sir William also spoke of mustard gas as an aid to warfare, at another meeting he showed that much of the opposition was based upon false premises and that it was shown by experience that poison gas is far less fatal and far less cruel than other forms of warfare. He pointed out that the responsibility for warlike operations rests upon the medical man and the chemist as fully as upon the soldier, contending that former philosophy of war has taken an entirely too narrow view of the situation.

Among the other papers and addresses of great prominence were those of Dr. Arthur D. Little, Dr. R. H. Baekeland; Prof. Wilder D. Bancroft; Dr. Edgar F. Smith, Dr. C. E. K. Mees, Dr. Charles Baskerville and many others which we can only touch upon briefly. Dr. Little spoke upon "Energy, Its Sources and Future Possibilities" in which he asked: "Upon what sources of energy may the world draw for the stupendous work of reconstruction at the requirements of the new social era, at the threshold of which we seem to stand?" In answer to the question he continued in part: "In appraising the sources of energy we must consider form values as well as quantities available. Gasoline can be utilized more effectively than coal. The development of waterpower involves a heavy initial expenditure, and therefore interest charges are the chief item of expense. In a steam station of the same considerable size—20,000 horsepower—interest shrinks to less than 20 per cent of the operating charge, and the high cost of coal at $3.25 delivered is nearly 50 per cent. The energy of the wind and the closely allied energy of the waves is too uncertain and diffuse to justify extensive exploitation. In a few exceptionally favorable locations it is feasible to utilize a trivial fraction of the total energy of the tides. The intermittent flow, the varying head, and the other special conditions involved in the problems are likely to hold the development of tidal power within closely restricted limits. Of extraordinary interest are the accumulating evidences of inconceivably great amounts of kinetic energy possessed not only by radium, but by ordinary matter as the constitutional energy of its atoms. We now recognize that concealed in matter of every kind are stores of energy immen[illegible]ter than those derived from chemical react[illegible]oncerned with any of the forces with which w[illegible]ly deal. We recognize them as of an altog[illegible]her order of intensity and magnitude than t[illegible]nergy derived from burning coal or liberated from the most powerful explosive. So stupendous and far-reaching are the possibilities contained in the suggestion that we may ultimately be able, without destruction, to draw upon this energy supply of which Rutherford has said: 'The human race may date its development from the discovery of a method of utilizing atomic energy.'"

THE meeting of the American Chemical Society and the Society of Chemical Industry, which was held in New York a few days ago as a prelude, so to speak, to the Seventh National Exposition of Chemical Industries, resulted in a sheaf of addresses. These addresses were more than remarkable — they were epoch-making. Nothing of late has served to open our eyes more to the possibilities of the immediate future in the field of chemistry than many of the remarks and predictions and hypothesis of the leading chemists gathered at the various sessions. We assigned one of our Staff, Mr. A. A. Hopkins, to attend the various meetings and to report the most important features in these columns.—THE EDITOR.

Dr. C. E. K. Mees, of Rochester, explained the tremendous part that research work has played in the world's development during the past forty years. "Diffusion and Its Relation to Civilization" was the topic of Dr. Ernst Cohen, professor of chemistry at the University of Utrecht, Holland. His address was especially analytical as well as technical.

Dr. Charles Baskerville delivered an address entitled "Science and Civilization, the Rôle of Chemistry," which concluded in the following words: "Chemistry must plan a great rôle in preparing the dramatic generalizations necessary for the third part of this master human guide, the 'cement' will bind mankind in brotherhood. With all deference to the followers of all the arbitrary divisions of science, it may be positively asserted that life processes depend upon chemical changes, speed of the changes, diffusion of the products, energy involved, its direction, and what-not other factors with many of which we are already familiar through published researches. Their direction will depend entirely upon the factors in the systems and how man controls them. Unleased energy might bring sudden destruction. Super-controlled energy may result in equilibrium. When equilibrium of energy has come about, none will be available and life, all life, inorganic as well as organic, will cease. Our world will have come to an end. The degradation will be as imperceptible as the growth. That which is and was returns to that which has been forever. The quiescent ocean of energy in equilibrium, the source and recipient of all life. Creation's chorus is stopped, 'hid in death's dateless night. Gone—all gone—like the light on the clouds at the close of day.'" Dr. Baekeland predicted that chemistry will reveal new forces of vast aid to the race. It was a particularly brilliant address, ending as follows: "But motion, whether it be furnished by water rushing from a waterfall, or by steam or gas engine, or by a windmill, can be made to turn a dynamo and produce electrical energy. The latter, in turn, can be changed into motion, heat or light. Or again, we can bridge directly that jump between a chemical reaction and light by simply burning oil, gas, acetylene or magnesium, and thus produce any range of even the most intense light. In other cases, we use heat or electricity to decompose the most refractory substances into their elements, and some of our largest electric chemical industries at Niagara Falls are based on this. Or we may use either one of these forms of energy in chemical reactions which build up; which, in other words, bring about chemical synthesis. But when it comes to transform light energy into chemical synthesis we have left thus far the monopoly of this to Nature; we have been acting as Rip Van Winkle."

The value of theoretical knowledge was emphasized in an address entitled "Theories," delivered by Dr. Willis R. Whitney, of Schenectady, N. Y., a research chemist connected with the General Electric Co. Dr. Whitney, in the beginning of his address, spoke as follows: "I define theory as mental concept as distinct from practice, which is always material. But for the scientist the combination of these two is necessary. They may be antithetical but they are not antagonistic. As allies, they are invincible. A theory is a means of satisfying the mind, when, for sake of economy, order and mental increase, various thoughts first form into a conjecture, then into an hypothesis, and then into a full grown theory. This is always a process concerning some selected group of apparently related observations. There is warrant for instinctive appreciation of theory in science. The world owes the present stand of organic chemistry to a beautiful combination of theory and experiment. We now see it plainly in this industrial situation. In 1856 Perkin produced the first artificial dye. At that time Kekule was theorizing, and he then laid the foundation of all our modern structures. His theories, which soon led into the wonderful conception of the benzene ring, are now the A B C of the dye industry."

Salvage of the by-products of industry, substitutions for natural materials that are difficult to obtain and more economy by manufacturer and user were the general subjects of a score of papers read before various sections of the American Chemical Society at Columbia University. With natural resources dwindling and manufacturing organized on a vast scale, the research laboratories of the chemists have been assigned to these tasks. The salvage problem was taken up extensively by the section of petroleum chemistry, and Dr. Sidney Born, of Muskogee, Okla., said that millions of dollars could be saved annually by the re-

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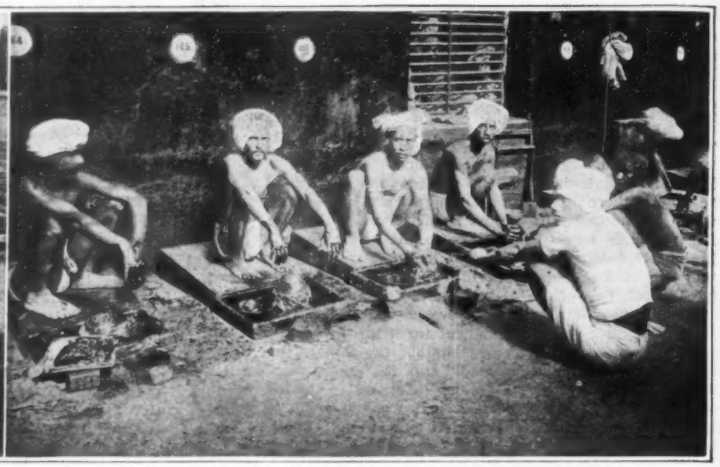
Drying opium for local use in India



Cake makers about to begin work in the opium factory

Juice of the Poppy

The Cultivation, Manufacture and Taxation of Opium in India

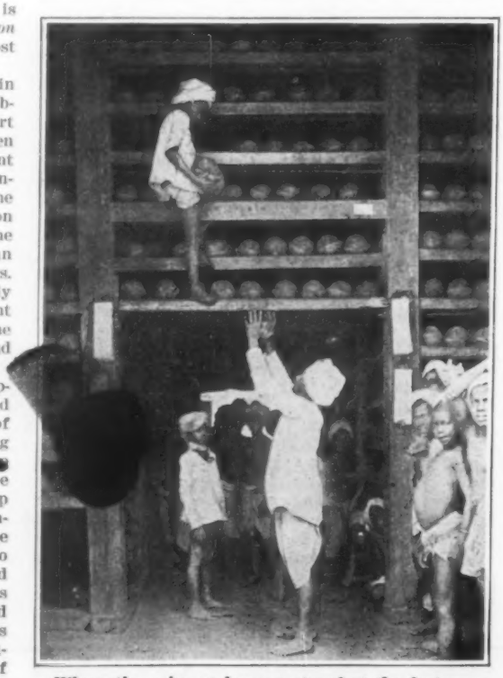
By T. Gibb

OPIUM is an inspissated juice, obtained by scratching the unripe capsules of the opium poppy *Papaver Somniferum* and allowing the milky sap, which exudes therefrom, to dry spontaneously. There are two main varieties of the drug—that used for medicine (produced chiefly in Asiatic Turkey), and that smoked, eaten, etc. (grown in India and China).

All authorities are agreed that Asia Minor was the original home of the *Papaver Somniferum*. The merits of its seed, as an article of food and as affording a sweet edible oil, were extolled by early Greek writers long before the somniferous property of the capsules had been discovered. The capsules, stems and leaves were employed by the Greeks in the preparation of an extract called *meconium* used in the fabrication of a soothing beverage corresponding to the *post* of the Punjab today. The Greeks must be credited with the discovery of the potent nature of the inspissated juice of the capsules which began to attract attention about the third century B.C. But, if this discovery is credited to the Greeks, the Arabs were chiefly concerned in disseminating knowledge of the plant and its uses. There can be no doubt that the followers of Islam brought a knowledge of the properties of opium, the *opion* of the Greeks, to the people of India and China. There is strong proof of this in the Semitic corruption of *opion* into *afyun* and *a-fou-yong*, the name of the drug in most Indian and Chinese vernaculars, respectively.

The history of the production and use of opium in India before the beginning of the 16th century is obscure. At the beginning of the 16th century the export of the drug from India to China had not only been fully established, but the cultivation of the poppy plant and the manufacture of opium had become regular industries. The State monopoly of manufacture of the drug, the strict government control of the cultivation of the poppy, and supervision of sale of the drug to the consumer, are direct legacies from the Muhammadan rulers of India, and from the early Portuguese traders. Control was assumed by the British in 1757 shortly after the battle of Plassey, and continues to the present day. Control of cultivation and manufacture of the drug is in the hands of the Opium Department; and supervision of sale rests with the Excise Department.

The opium year opens in September, when the preparation of the land for the reception of the poppy seed commences. The soil is ploughed, at an interval of every ten days, till the middle of October when sowing begins. Land in the immediate vicinity of the village is selected on account of its being higher, usually more richly manured, and more easily supervised. The crop requires an abundance of water, and irrigation commences as soon as the plants appear. The plants take from 75 to 80 days before full flowering can be said to be attained. The petals, four in number, are removed from the capsule the third day after expansion. This operation demands considerable skill, since, if plucked off before they are ripe, the capsule afterward produces much less opium than if the petals are allowed to mature fully. The hand is placed gently round the base of the flower, drawn upwards, when, if properly matured, the petals come away naturally. After collection they are made into what are technically called "leaves." To accomplish this, a handful of petals is placed on an earthen plate over a slow fire. Over the petals is placed a damp cloth and pad, and the steam from the cloth causes them to adhere together. The thin cake thus formed is turned over, and the damp pressure repeated to ensure the union of the petals on both surfaces. The "leaves" have a pleasant aroma which they are said to impart to the opium for which they are employed, subsequently, as packing material. The collection of the drug begins immediately after the gathering of the petals. The green capsules are scratched in the afternoon with an instrument called the *nashtar*. This consists of four sharp blades tied together with cotton, and with a padding of same between each, so as to keep them about one-thirtieth of an inch apart to allow of scratchings being made to a certain depth through the wall of the capsule and no further. It is important that the wall of the capsule be never completely severed; but, at the same time, a purely superficial scratching is useless. The exact degree of penetration, to ensure the best possible flow of juice, requires considerable skill. Incisions are made from below upward. As a rule, each capsule is lanced in this manner three or four times at intervals of two or three days. Sometimes a single scratching may exhaust the flow, while, occasionally, an extra fine capsule may give eight to ten discharges. The field is divided, usually, into portions, so that scratchings may be performed, in regular rotation, until the entire crop is collected. The juice adhering to the incisions is scraped off with a small trowel-shaped scoop of thin iron called the *setwah* in the early morning on the day following the scratching. The drug is transferred from the scoop to a metal or earthen vessel and conveyed to the farmer's house for further manipulation. It is stored in an earthen pan tilted to one side to allow the liquid *pasewa* to drain from the more solid extract, the crude opium, which in the case of opium grown in British India, finds its way, in the manner to be described later, to the Government opium factory at Ghazipur.



Where the opium cakes are stored at the factory

Here the crude opium is first tested for purity and quality, and stored in large wooden boxes. During storage it deepens in color by exposure to air and light. The quantity to be manufactured daily is sampled, assorted, kneaded together, and thrown into boxes. The opium is next placed in troughs, kneaded, and thoroughly mixed by men wading knee-deep in it. When uniformity has been attained by these various stages of separating, sampling, mixing, and kneading, it is next day made up into cakes. For this purpose a supply of "leaves," *lewa*, a paste made of inferior opium and *pasewa*, and "trash" (pounded poppy stalks) is required. The "leaves" and opium required for each cake are accurately weighed out. The operator, taking a brass cup in his hand, places the "leaves" within it layer upon layer, after moistening with the *lewa*, and builds up a *shul*, and "leaves" moistened in the *lewa* are inserted until the space round the cake is filled up. The "leaves" are then brought up over the opium and pressed together until the finished cake resembles a Dutch cheese in size and shape. It is then removed from the cup, rolled in the "trash," placed in an earthen cup of a size to hold it comfortably, and dried through exposure to the sun. Half the weight of the average cake consists of the *shul* that surrounds it. Opium prepared in this way is packed into chests intended for export from India. The opium intended for sale in India is inspissated by direct exposure to the sun until the standard consistency is attained. It is then moulded into cubical cakes of 3½" dimension and weighing about two pounds, which are wrapped in oiled Nepal paper and packed in chests for transport.

Two main centers of opium production in British India are (a) the districts of the United Provinces of Agra and Oudh lying along the Gangetic valley and north of it and (b) the Native States in the Central India and Rajputana Agencies, the chief of which, for opium purposes, are Indore, Gwalior, Bhopal and Mewar. There is also some production in Baroda. Opium grown in (a) is termed Bengal opium, that in (b) Malwa opium. The whole of the drug consumed in British India, with the exception of unimportant im-

ports from Afghanistan and small native states in the Simla Hills, is of the Bengal variety collected by the opium department and manufactured at the Government factory at Ghazipur. Cultivation in the Bengal opium region is permitted only under license from an authorized officer of the opium department; and the cultivator, who receives advances when required to assist him in production, is bound to sell the whole of his outturn to the department for manufacture at the Government factory. The factory, in turn, issues the manufactured drug to the Government treasuries in the various provinces at a price fixed to cover payments to cultivators, factory and establishment charges, etc. The drug is sold, again at a fixed price, from the treasuries to licensed wholesale and retail vendors for sale to the public. The opium revenue is represented by the difference between the factory price, *i.e.*, cost of manufacture, and the sale price at the treasury, which varies according to local circumstances. The vendors pay, in addition, a considerable fee for the right of sale. The total revenue recovered from both sources, in 1912-13, amounted to £1,200,000. The main source of the opium revenues of India, however, is the export tax which is levied in the following manner. The opium prepared for export by the Government factory is despatched to Calcutta for sale there by public auction. The number of chests to be thus disposed of is fixed, annually, by the Government of India, according to probable requirements. The sales are conducted monthly, by the Bengal Board of Revenue. During the year 1912-13 900 chests were sold which, after deducting expenses of production, realized a net profit of, approximately, £4,526,000, which represents the taxation on exports. The chests, on sale, become the property of the exporters, but must be shipped under passes granted by the Board of Revenue, and subject to conditions which prevent the opium being used for consumption in India. Till so shipped the chests remain in the official storerooms.

As observed above, Malwa opium is, almost entirely, produced in Native States, and there the Government of India do not control its production or sale. This opium was formerly exported to China; but with the cessation of the opium trade between India and that country export has entirely ceased. The last exports took place in 1913-14 to the extent of 2760 chests. While the trade lasted each chest, on export, paid a tax of £80 to the British Government. The import of Malwa opium into British territory is prohibited; but parcels of the drug are occasionally purchased by Government for blending with the Bengal variety at the Government factory.

The Government of India have always regarded the opium trade as one which needed careful control, and in recent years have adopted a very definite policy of restriction. This forward policy dates from the decision of the Chinese Government to suppress opium smoking, and the findings of the International Opium Commission which met at Shanghai in 1909. The necessity for the suppression of opium smoking, and the advisability of either prohibiting or regulating carefully the use of the drug for any other purpose, are fully recognized. Opium smoking is uniformly reprobated in India. The sale of opium for smoking is absolutely

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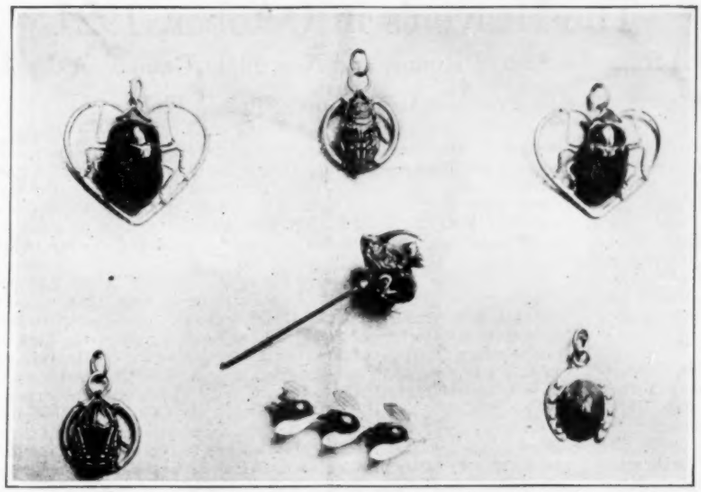
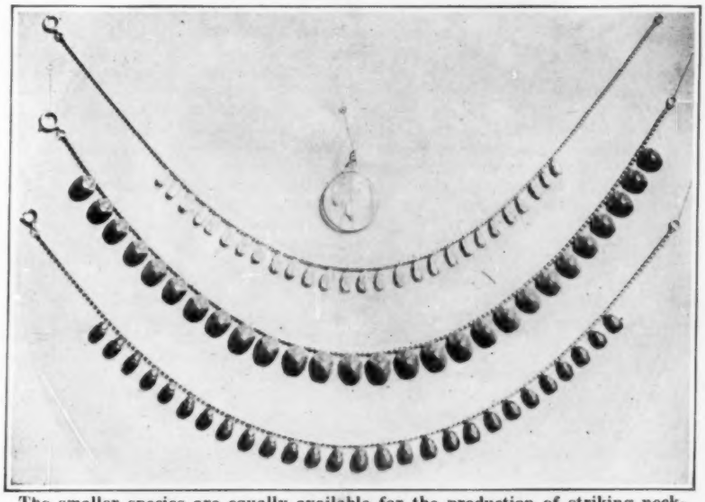


Some of the attractive stick-pins and similar large pieces of jewelery made up about a beetle or other insect as a base



The smaller species are equally available for the production of striking necklace effects, and even the butterfly can be hung about milady's neck

The Jeweler and the Beetle

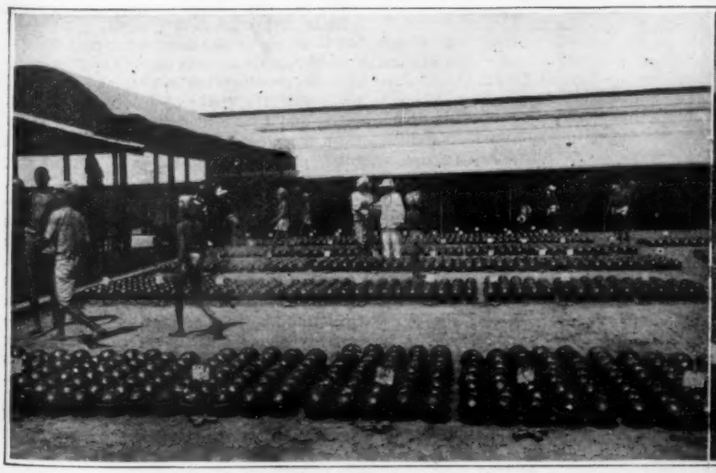
THE Pharaohs of old Egypt had their scarabs, and in collections and museums we may still see these curious jewels. But modern times have not seen any material use of insects or insect patterns in the jeweler's arts. Today, however, there is quite a vogue in Paris calling for the incorporation in pendants, necklaces and pins, not of the mere counterfeit presentment of insects, but of the actual insects themselves, preserved in one way or another. The Parisian jewelers follow here the lead of the Egyptians, in that they employ for the most part exotic coleoptera (in the vulgar tongue, beetles) of warm and iridescent colorings.

Our illustrations indicate some of the possibilities, and make it appear that the beetle jewelry, in spite of its bizarre character, has certain features of attractiveness. The smaller species, like the lady bugs or lady-birds or lady-beetles, known under one or another of these names wherever English is spoken, are for the most part seen in the form of necklaces or circlets of some description; while the larger beetles are nicely available for use, single, in more pretentious ornaments of the clasp or brooch or stick-pin order. We are assured by the French contemporary from which we glean the particulars of this curious fashion that the insects worn by miladi in this manner are by no means stone replicas, but actually the natural insects themselves, metallized or ossified according to one of several processes known for this purpose. The variety of treatment of which this type of jewelry is susceptible is wide, and the results far from displeasing.

Discovery of Unknown Substance in Soil

PROCLAIMED by the Bureau of Soils, United States Department of Agriculture, as the most notable discovery pertaining to the science of soils within recent years is that of identifying a hitherto unknown substance in the earth. Designated as ultra-clay, its characteristics are described as being sticky and plastic when under the influence of moisture and resembling resin when subjected to a drying atmosphere. When analyzed, it has the appearance of being a silicate of alumina, partaking of some iron and traces of potassium, sodium, magnesium, and calcium.

The discovery is reported to have bearing on the physical properties of soils, a factor for consideration by the Bureau of Public Roads in determining its relation in adjusting the structure of concrete and other road surfaces to the texture of the soil serves as their foundations. The ultra-clay, according to an opinion of Government experimenters, is a primary contributing agency in rendering the soil plastic. Briquets constructed of ultra-clay crumble in water while Portland cement retains its form.—By *S. P. Winters.*



Opium cakes in the drying yard

Consignments of raw opium ready for examination at the factory

The Heaven's in October, 1921

Betelguese Dethroned from the Seat of Honor, and New Light Gained on the Atmosphere of Venus

By Professor Henry Norris Russell, Ph.D.

A NUMBER of interesting astronomical items, mostly from the Pacific Coast observatories, have recently been made public and may be reported here.

Professor Sitken at the Lick Observatory finds that the remarkable nebula surrounding the "new star" which appeared in Aquila in 1918 is still visible. It has now reached a diameter of five seconds of arc, and—if the velocity of expansion is about 170 kilometers per second, as indicated by the spectroscopic data—its real diameter must be about 2200 times the earth's distance from the sun.

Throwing Betelguese in the Shade

Mr. Pease, at Mount Wilson, working with Michelson's interferometer, has measured the diameter of another star—Antares—the brightest member of the constellation Scorpio. The apparent diameter, 0".039, is a little less than that of Betelguese, though much greater than that of Arcturus; but the real diameter is extraordinarily large. Antares shows the motion of the neighboring bright stars in Scorpio, which Kapteyn has shown to belong to a great cluster, at a distance of between three and four hundred light-years from the sun. For the individual stars of the cluster, the distances can be more accurately determined, and that of Antares is found to be 370 light-years, corresponding to a parallax slightly less than 0".009. It follows that the true diameter of this star is 420 million miles—more than twice that of the earth's orbit, and half as big again as Betelguese.

Startling as this result may seem, it has been pretty well anticipated by students of stellar matters. Antares, though looking fainter than Betelguese, is twice as far away, and is in reality three times as bright. Moreover, it is fully as red as Betelguese, and so probably gives out rather less light per square mile; so it is not surprising to find it the bigger of the two stars. Its actual luminosity is about 3000 times that of the sun; but according to these measures its diameter is about 500 times the sun's, and its superficial area about 240,000 times as great. This shows that, per square mile, Antares gives out only one-eightieth as much light as the sun—that is, that the surface of this star is much less luminous, and probably cooler, than the darkest parts of any sunspot. This again is not really surprising, for the spectrum of Antares marks it decisively as one of the least intensely heated of the stars.

Additional evidence of the remarkable, and almost unique, character of this great luminary is found in an observation by Mr. Joy—also with the 100-inch telescope at Mount Wilson. Antares has a much fainter companion, three seconds of arc away, which is so overpowered by the rays of its great neighbor that it affords a rather severe test of the defining power of telescopes of moderate dimensions. This companion appears vividly green—but until recently it was uncertain whether this color arose merely from contrast with the deep red of the primary, or was real. Mr. Joy's spectrographs show that the companion is remarkably unlike Antares. Its spectrum is of the Orion type—B3 on the Harvard scale—which means that it is a very hot star indeed, much above the temperature of Sirius, and far exceeding the sun. Though so hard to see in the glare of Antares, it is really fairly bright—of about the sixth magnitude; and its real luminosity must be about fifty times that of the sun, or twice that of Sirius. Being so hot, it probably shines very intensely—twenty times the sun's surface brightness being a low estimate; and we may therefore conclude that its linear diameter is not far from one million miles.

Though the companion is so extraordinarily unlike Antares in almost every particular, the two stars undoubtedly form a true binary pair. They are moving together in space, and show traces of orbital motion, which however is exceedingly slow.

It is worth emphasizing that it is Antares, and not the companion, which is the exceptional object. Almost all the other stars which belong to the "Scorpius cluster," as Kapteyn calls it, show the B type of spectrum; and the companion of Antares, though fainter than most of the others, does not differ from them very materially. It is only the presence of its enormous neighbor that makes it seem insignificant.

The Atmosphere of Venus

One more bit of news, also from Mount Wilson, may be mentioned. Dr. St. John and Mr. Nicholson, photographing the spectrum of Venus, have made a very careful search for lines arising from absorption by oxygen and water vapor in the planet's atmosphere, with the very interesting conclusion that no trace of either can be found. This investigation would have been very easy, except for one obstacle that made it very difficult. The spectral lines in question are in the red but can be very easily photographed with modern plates. But the earth's atmosphere is full of oxygen and water vapor, and heavy lines arising here are always present, complicating the situation greatly. It is possible, indeed, to go boldly ahead, observing the combined effects of the atmospheres of the earth and the planet, and then attempt to disentangle the two; but a better road was pointed out some years ago by Campbell. If Venus is observed near elongation, when her distance from the earth is changing rapidly, the lines produced in the atmosphere of the planet will be shifted toward the red or toward the violet by an amount corresponding to this radial velocity; while the lines produced in the earth's atmosphere will be unaffected. By using a spectroscope of high dispersion, the two sets of lines may be separated clearly, so that, if oxygen is present in the atmosphere of Venus, each terrestrial line will have a close companion.

When the photographs were examined not the faintest trace of such companion lines appeared, and there seems to be no escape from the conclusion that if oxygen or water vapor exist at all in the atmosphere of Venus, they must be present only in minute amounts—the merest traces.

This surprising result is confirmed by simultaneous and independent observations by Dr. Slipher at the Lowell Observatory, using the other method, and comparing the intensity of the lines in the spectrum of Venus (arising from the combined absorption in the atmospheres of the planet and the earth) with those in the spectrum of the moon, where nothing but the earth's atmosphere comes into play. Careful measures led to the same conclusion—the amounts of oxygen and of water vapor in the atmosphere of Venus are negligibly small.

It must be remembered that these results apply only to that part of the atmosphere of Venus which lies above the visible surface. It is fairly likely that this surface is composed of clouds. If these clouds are like the high cirrus clouds on the earth, they may lie at the very top of the part of the atmosphere into which water vapor is carried by ascending air-currents, and the upper regions, as here above the earth, may be almost absolutely dry.

But the apparent absence of oxygen is more puzzling. We naturally expect to find oxygen in the atmosphere of another planet, because it exists in our atmosphere and we cannot live without it. But after all, free oxygen is a remarkably active chemical substance to remain permanently in an atmosphere. We know that on earth it is being continually consumed by chemical action, and as continually renewed by the activity of vegetation. On a lifeless planet, there would be presumably very little oxygen in the atmosphere. Hence we may take these recent observations, tentatively, as indications that there may be no life on Venus. The application of the same test to Mars (which involves much more serious observational difficulties) may go far to settle the vexed question of the existence of life upon the surface of this planet.

At 11 o'clock: Oct. 7.
At 10⅓ o'clock: Oct. 14.
At 10 o'clock: Oct. 22.

At 9¼ o'clock: October 30.

At 9 o'clock: Nov. 7.
At 8⅓ o'clock: Nov. 16
At 8 o'clock: Nov. 23.

The hours given are in Standard Time.

NIGHT SKY: OCTOBER AND NOVEMBER

The Heavens

Our map shows the appearance of the evening skies. We may begin right overhead, at Pegasus, marked by the great square whose eastern side is just on the meridian. This edge, carried down and bent a little to the left, points out the second magnitude star Beta Ceti. The western edge of the square points downward to the brighter star Fomalhaut, in the Southern Fish. These two are the only prominent objects in the southern sky.

In the west we find Aquila, and in the northwest Lyra, with Cygnus above. The Great Bear is low on the northern horizon, with Draco and Ursa Minor above, and Cepheus and Cassiopeia still higher. Gemini is rising in the northeast, and Auriga and Perseus are above. Orion is on the eastern horizon, with Taurus above him, then Aries, and Andromeda above all. Eridanus and Cetus fill the dull southeastern sky.

The Planets

Mercury is an evening star, except on the last day of the month. On the 7th he is at his greatest elongation, 25° east of the sun, but is so far to the southward that he sets at about 6:30 P. M., and is hard to see (as is always the case when he is an evening star in autumn).

Venus is a morning star, rising at 4 A. M. in the middle of the month, and very conspicuous.

Mars is also a morning star, and so are Jupiter and Saturn. All four planets are close together in the sky, and a series of interesting conjunctions occurs as Venus, which is moving eastward faster than the others, overtakes them one after another. On the 3rd she comes within eleven minutes of arc of Mars; on the 22nd she passes 35 minutes south of Jupiter; and on the 25th she is 31 minutes north of Jupiter. Between these dates all four planets are crowded into a space no longer than the belt of Orion, and as they are far enough from the sun to be easily visible before daybreak, the display will be well worth getting up to see—especially as such triple conjunctions are rare. The last in which these planets figured happened twenty years ago.

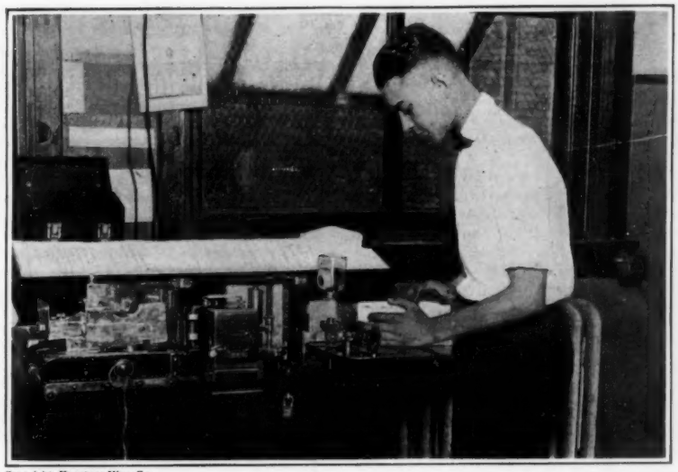
Uranus is in Aquarius, and is observable until well after midnight. Neptune is in Cancer and rises about 1 A. M.

(Continued on page 243)

Doing Away with Postage Stamps

ONE of the latest aids to expediting business, at least the office routine phase of business, is a machine that does away with stamps on pieces of mail. This machine, the invention of Arthur H. Pitney, is being tried out by leading banks and large concerns in New York City, with the aid of the Post Office, in order to determine whether it can eliminate the paper stamps altogether.

After all, the idea of the paper postage stamp is to show that a certain sum of money has been paid to the Post Office. The affixing of a stamp to any piece of mail matter indicates the exact amount of money paid. Any device that serves to indicate the same thing, and which insures the payment of the total amount of the mailing charges to the Post Office, obviously serves the same end. Such a machine is said to be represented by the new stamping machine, which is shown in the accompanying illustration. This machine seals the envelopes and prints a Post Office license in the usual stamp corner. The stamp printing machine cannot be started until the operator has inserted the meter which keeps track of the stamp impressions. The meter, in turn, is set by the Post Office officials and is sealed in such a manner that it cannot be tampered with. This meter keeps watch over the stamping activities of the stamping machine, yet may be removed and carried to the nearest post office for re-setting and for the payment of the postage stamped off by the machine. In this manner, so it would seem, the machine has solved the postage problem. It is said that on the average of 250 letters are stamped per minute and sealed in the same operation.

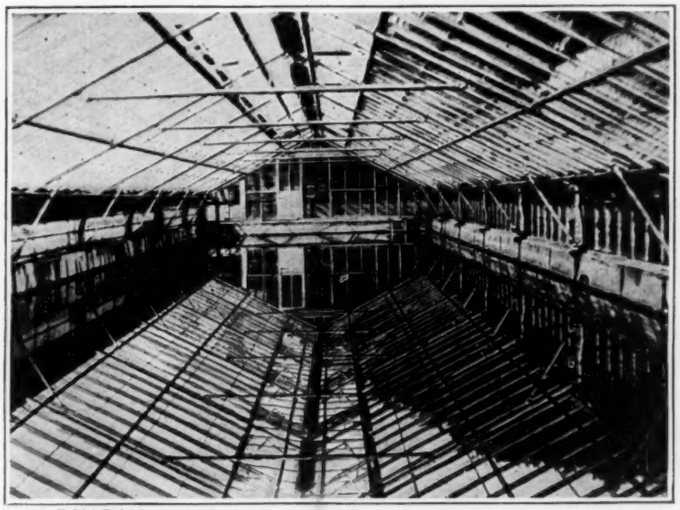


Copyright, Keystone View Co.

This machine automatically seals the envelopes and stamps them with a Post Office license that takes the place of the usual paper stamp

From Greenhouse to Swimming Pool

NOT because he loved flowers less but because he loved swimming more, H. O. May, of Summit, N. J., converted his greenhouse into a swimming pool, as shown in the accompanying view. In fact, it would seem that Mr. May's improvision has worked out very nicely, for the cement floor and sides of the usual well-constructed greenhouse require little additional work and materials to form a highly satisfactory pool. Then there is the splendid sunshine which pours through the glass roof and sides, so that even in the coldest weather the pool is kept warm, especially with the aid of the usual steam pipes which line the greenhouse.



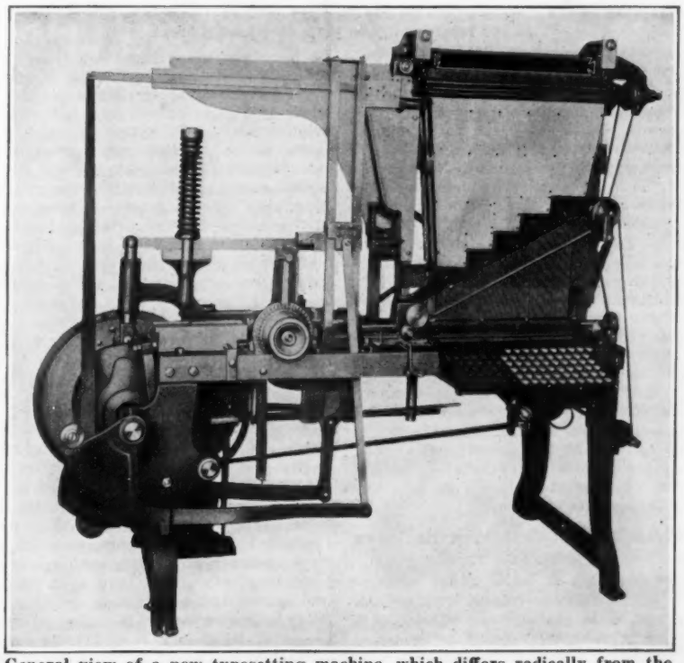
Copyright, Kadel & Herbert

Which is top and which is bottom? Perfect reflection in the greenhouse swimming pool of a New Jersey resident

A Novel Departure in Typesetting Machines

ON the very face of it, it would seem as though two inventors, A. F. Osterlind and F. C. Damm, both of Saint Paul, Minn., have replaced the complicated and bulky type-setting machines, which have long been characteristic features of the modern printing plant, with a machine that startles one with its absolute simplicity. We learn that the two inventors had been working along the same general lines for many years, but it only required the meeting of these two minds and the exchanging of their ideas some two years ago to bring about this new conception in type-setting machinery.

The new machine is a matrix-setting line-casting device, containing many features not heretofore attained by other machines of like nature, so claim the inventors. The line is assembled the same, but when assembled the operator touches a key and the line automatically passes directly into the jaw, in position for casting. Each line is followed by a master matrix which holds the succeeding line. There is no elevator to wait for, nor are there any return stops or springs, all of these annoying features being discarded entirely, and the line when cast is ejected by means of the liner which is a part of the mold. The length of the line is determined by a dial that can be set in less time than it takes to tell it—varying from 2 ems to 38 ems in length, and from 5 point to 42 point in thickness. The machine especially intended for the large display types of advertising composition, has a range from 42 point to 102 point.



General view of a new typesetting machine, which differs radically from the usual equipment of this kind

The magazines, of which there are six, are shifted to position simply by operating the small lever up or down, the movement being about one inch for each change. There are no cranks or wheels to turn—each movement is positive and accurate and made instantly.

The metal pot holds 100 pounds of metal. The well is separate from the main pot, though heated by the same flame. The mouthpiece and throat are easily accessible by means of a very ingenious method, making cleaning a matter of minutes rather than hours and no special saws, brushes, drills or tools are necessary. The slugs cast by the machine are solid top and bottom, supported in the center by a solid support.

In sum, the new type-setting machine is claimed to be unequalled in the matter of speed, due to the simplified mechanism. Only one-half as many parts are needed in this design, as compared with the usual type-setting machines.

A Word to Inventors and Licensees

WE think it well to warn patentees who grant licenses for the use of their inventions, that they should be careful to protect themselves from unscrupulous parties who take advantage of the present state of our patent laws to deprive inventors of a part of their profits to which they are morally entitled.

We refer particularly to the case where the licensee of a patented device, which he has not purchased, keeps it in repair by replacing broken parts made in his own shop or factory; sometimes even going so far as to buy from unlicensed makers a line of repair parts to be kept in stock and used on occasion.

This is morally wrong, but as the law allows the licensee of a patented machine to make repairs in case of breakage or failure, without clearly defining to what extent such repairs may be made, many licensees systematically replace broken parts as above alluded to—a practice which in course of time results in the production of an entirely new machine with nothing of the original structure left.

In view of the above, inventors would do well, when selling their patented devices, or licensing others to use them, to have their contracts so drawn as to require the licensee to purchase from the owner of the patent all replacements for broken parts.

It appears that the chief delinquents in the premises are the railroad companies. One reason for this may be found in the fact that repairs to railway machinery have to be made in the shortest possible time to prevent traffic delays, and during the war there was some excuse for thus encroaching on the rights of patent owners. But we are now getting back to normal times, and the fact that property in patents is just as inviolable as in chattels or real estate should not be lost sight of, especially by the railway people. It may safely be said that our vast railway system has been built up by our patent system. An examination of the patent records of the United States and Great Britain discloses that nearly all the improvements in railway machinery were originated by inventors and have come to us through the Patent Office.

It would seem that the law as it now stands works an injustice to inventors in the way we have indicated, and we think some amendment would be advisable.

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Edge view and flat view of a screw-driver that holds screws by means of their slot

A Screw-Driver that Holds Tight

A WISCONSIN man has recently introduced an interesting automatic self-holding screw-driver. The screw is placed on a two-point blade and locked by a spring lever rod. It is claimed that this tool may be used around electrical or running machinery because of its insulation against current leakage and its power of holding a screw without danger of dropping it.

One-Million-Volt Transmission Experiments

SUCCESSFUL generation of electric power at more than one million volts at commercial frequencies has just been accomplished at the High Voltage Engineering Laboratory of the Pittsfield Works of the General Electric Company. During the course of the experiments, just completed, much valuable data was gathered indicating the feasibility of considerably higher transmission voltages.

Physical laws applying to high voltage phenomena were found to hold good at these enormous potentials. In the course of the experiments the gap spacings for sphere and needle spark gaps were carefully checked up and prolongation of existing curves (750,000 volts and below) were found correct up to 1,100,000 volts.

Arc over tests were also made on strings of standard ten-inch suspension insulators up to 1,100,000 volts. The laws of corona were checked at similar potentials and found to hold. A short transmission line was tested for corona conditions and results indicated that a line using four-inch diameter conductors or larger would be necessary at 1,000,000 volts.

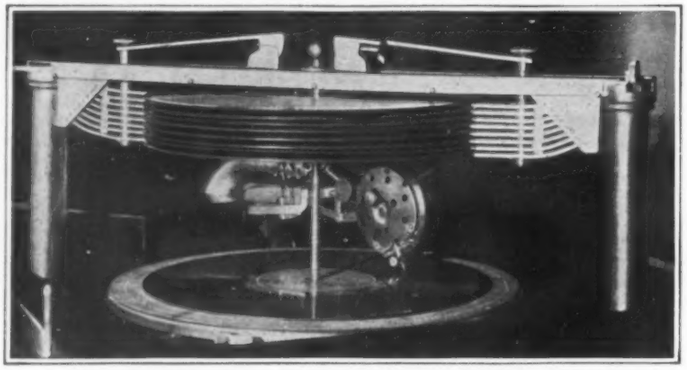
The successful conclusion of the tests is the result of more than thirty years of constant experimentation during which time transmission voltages have arisen steadily from the first 15,000 volt line built in Pittsfield in 1891 to the present record breaking voltage of 220,000 volts, equipment for which was recently shipped from Pittsfield and is now being installed on the Pacific Coast.

The million-volt tests confirm the belief of the Pittsfield engineers that it will be commercially feasible to use considerably higher voltage in the transmission of power and indicate the extension of long-distance transmission beyond limits heretofore believed possible. Electrical engineers are now in a position to forecast results.

A diminutive pair of field glasses that may be worn in the same manner as spectacles

Fifteen to One Hundred Phonographs Records Without a Stop

THE latest novelty in the phonographic field is a machine that handles its records automatically, and continues playing one record after another until the supply is exhausted. Indeed, as many as one hundred records may be played without a break and without attention of any kind.



One record at a time is automatically dropped on the turn-table so that as many as 100 records may be played without a break

The device which makes this automatic operation possible is shown in the accompanying illustration. A batch of records is placed on the turn-table of the phonograph, and all but one record are raised by hand and held in place by the arms or fingers mounted on the pillars on either side of the turn-table, as shown. When a record is through playing, the tone arm automatically lifts and falls back, whereupon a new record is deposited on the turn-table. It is said that the record is carefully dropped in place, with no danger of breakage. The tone arm is then brought into position with the stylus in the first groove, and the record begins playing. By extending the pillars upwards and mounting more arms or fingers on them, the capacity of the machine can be increased up to one hundred records. Obviously, an electric motor drive must be employed for the phonograph so as to do away with manual rewinding.

Field Glasses that May Be Worn Like Spectacles

IF the idea of huge arenas is to be pursued in the future, with popular priced seats placed some quarter of a mile or more away from the center of interest, it stands to reason that some aid to vision will be more and more required. Field glasses are a solution, of course; but no one will gainsay the fact that field glasses become tiresome when held in the hands for any length of time.

Why not have field glasses that may be worn like spectacles, asks an inventor; and he has set to work on this idea, developing the neat little field glasses shown in the accompanying view. Here are diminutive field glasses, with moderate magnification, that may be adjusted to each eye in the usual way and then worn by means of a pair of bows. This design does away entirely with the tiresome practice of holding the usual field glasses, and it is claimed that the lenses are better centered and therefore result in a minimum of eye fatigue.

The Handy Fruit Scales

PERFORMANCE at the pail of the favorite milk cow is frequently a matter of record, and why not have an accurate knowledge of the producing-powers of a lemon tree? The axiomatic saying, "You are being handed a lemon," may be frowned upon elsewhere—but not in California.

The essential distinction is revealed by numbering the trees and weighing their respective output during the harvesting season. Thereby individual-tree performance records are maintained over a period of successive years. The numbers are painted on the tree trunk, one man being capable of numbering 175 trees a day. The methods of weighing the fruit, the final test indicating inferior or drone trees that should be top-worked or eliminated, varies according to the special kind of weighing apparatus designed for the purpose.

The weighing equipment is a constant companion of the picker, whether it is attached to his fruit cart or strapped around his waist. The formation of the picking crew is such that one man gathers the lemons of an individual tree, jotting down in black and white on his ledger the record of each tree.

A novel weighing apparatus, sanctioned by the Department of Agriculture, is the suspension of a spring balance from the picker by means of shoulder harness. The scales are capable of weighing as much as 50 pounds. Steel hooks clinched to the ropes provide an easy arrangement for hooking-up to the ends of the lemon box. The weigher attaches the hooks to the ends of the box, rises in an upright position, thereby lifting the box from the ground.

An ingenious form of swivel fire-hose stand for the industrial plant

A Swivel Fire-Hose Stand for the Factory Yard

IN the yards of an oil company located in San Francisco, Calif., there may be found an ingenious type of swivel fire-hose stand which is shown in the accompanying view. The device consists of a pipe extending up from the ground and protected by a concrete pyramid from being struck by passing vehicles. A frame is arranged on the pipe, for the purpose of carrying the neatly folded hose. This frame can be turned in an entire circle, and is ready at a moment's notice for action. A valve is placed at the top of the pipe. Several of these swivel fire-hose stands have been placed about the yards in question and are giving entire satisfaction, so it is reported.

Locating the Missing Spark of the Automobile

A CHICAGO inventor has recently developed a simple device which proves unusually efficacious in locating missing spark plugs in an automobile, airplane, motor boat or other power plant of the internal combustion order.

In brief, this device consists of a simple handle, two electrodes for making the necessary contacts with the circuits to be tested, and a small variable spark gap. To test a spark plug, the electrodes at the end of the handle are placed as indicated in the accompanying illustration. If the spark gap flashes intensely, it is an indication that the spark plug is missing. Various troubles may be detected by the intensity of the spark, and the gap may be varied in length to determine the setting of the spark plug points. Thus spark plugs are tested with little less of time.

A simple device and how it is applied to spark plugs to detect ignition trouble

Getting a Line on the Higher Atmospheres

(*Continued from page 233*)

end of which is linked with the recording style. Another deviation from standard meteorographs is the employment of a single time arc for all markers. The pivots of the styles are supported by a one-piece aluminum casting, and all three of the axes are at the same height. Shock-resisting qualities being imperative—in contemplation of the use of the instrument as an accompaniment of the Goddard exploring rocket—it was so designed as to reduce disturbances in the mechanical arrangement to a minimum.

To the ends of resisting ordinary stresses, strains in the support for the edges and cylindrical parts of both the case and base have been as far as possible counteracted. The former is of hard sheet aluminum, .2 millimeters thick, and the cover is secured by a lock seam instead of rivets. The sides are braced by two or more deep "beads" or ribs. The bottom edge is double, and is fastened to the base by machine screws. A sliding door affords access to the mechanical parts, the clock drum being removed through an opening in the top of the case.

The parachute, weighing 50 grams, including accessories, is but one-third of the lightest one in use as employed by Teisserero de Bort, a Frenchman. The parachute, however, may be dispensed with for aerological errands and two pieces of brilliant silk attached to the apparatus as a substitute therefor. These strips from the silkworm factory serve the twofold purpose of retarding the descent of the equipment and in focusing attention of weather observers to the information-bearing machine having returned to earth. And in conclusion, to reduce the lightest weather-recording instrument to weights and measures: Its external length is 210, height 90 and greatest width 80 millimeters. The clock-drum is 80 millimeters in length, 57 millimeters in diameter, and the time-scale 3 millimeters a minute. The weight of the clock and drum, including a cover for the timekeeper, is only 65 grams.

The Role of Chemistry

(*Continued from page 237*)

covery of petroleum that had been mixed with water in the wells. He described several of the salvage methods. Along the lines of conservation George G. Brown, Jr., a graduate of New York University and an instructor in the chemical engineering department of the University of Michigan, told of his research work in connection with saving gasoline in automobile operation. His assertion that the ordinary driver of a Ford automobile could average more than thirty miles on each gallon of gasoline created such interest among the chemists that he was asked to repeat his talk before the section of petroleum chemistry. The title of his paper was "A Chemically Controlled Automobile."

The last formal exercise of the session of the society was held in the Columbia University Gymnasium, September 9th, when C. A. Browne, Chairman of the Priestley Memorial Committee, unveiled a copy of the Stuart portrait of the famous chemist. The portrait is to be given to the National Museum in Washington. It was at the grave of Priestley that two American chemists conceived the idea of the American Chemical Society. Dr. Edgar F. Smith, President of the Society, in his annual address at this meeting, reviewed some of the great achievements of American chemistry and said the future of the country was largely dependent upon scientific advancement and discoveries.

The exposition which was held beginning September 12th in the vast Eighth Coast Artillery Armory in the Bronx was a notable achievement and the hundreds of exhibits afforded a liberal education in chemistry and not one you could get in the schools either. Some of the devices shown will probably be illustrated later and in last week's paper we showed the most sensational and popular exhibit—a silk purse made from a sow's ear. Truly, the wonders of chemistry will never cease and chemistry now has her place, not in the sun for she can make her own sun if she sees fit, but she has a place in our daily economy whether in war or peace from which she will never be unseated.

Juice of the Poppy

(*Continued from page 239*)

prohibited. The practice of eating opium stands on a very different footing; and this is the common form which indulgence takes. As a vice it scarcely exists. As taken in moderation by the average Indian, opium is eaten either as a mild stimulant, as a prophylactic against malaria, for the relief of pain, or in the treatment of various ailments. It is, in fact, a household remedy for many ills, prescribed by centuries of inherited experience. Government policy is directed to prevent its misuse, and check excessive consumption. The obvious method of effecting this is to enhance the price, and this is being steadily done. No physical or moral degradation can be regarded as occasioned by the habit, at all comparable with the use of alcohol in Europe. The mean consumption, expressed to head of population in British India (including the high rate prevalent in Assam), comes to 38 grains per head per annum, and if Assam be excluded it is under 30 grains.

The Heaven s in October, 1921

(*Continued from page 240*)

The moon is new at 7 A. M. on the 1st, in her first quarter at 3 P. M. on the 8th, full at 4 P. M. on the 16th, in her last quarter at 11 P. M. on the 23rd, and new again at 7 A. M. on the 30th. She is nearest the earth on the 27th, and farthest away on the 11th. During the month she passes near Mercury on the 3rd, Uranus on the 13th, Neptune on the 25th, Mars on the 27th, Saturn, Jupiter and Venus on the 28th, and Mercury on the 30th. The triple conjunction on the 28th is notable, but is best seen from the opposite side of the earth.

As already described last month, there is a total eclipse of the sun on the first day of October, which however is of little importance, the track of the shadow falling in the ocean south of Cape Horn, and passing on the Antarctic continent.

Of more interest to us is a partial eclipse of the moon which occurs on the evening of the 16th. This is a large eclipse, only one-sixteenth of the moon's diameter remaining clear of the shadow. The earlier phases are invisible to us, though observable in Europe and China; for the moon enters the shadow at 4:16 P. M. by eastern standard time. By the middle of the eclipse, at 5:54, she will have risen upon the Atlantic coast; and before she quits the shadow at 7:34 she will be visible throughout the whole United States except the Pacific Coast. This is a very convenient eclipse for the amateur star-gazer, and is big enough so that the copper tint of the eclipsed moon, illuminated by light refracted through the earth's atmosphere, should be easily seen.

In conclusion it may be remarked that scattered observations, still incompletely reported, indicate that the bright object seen close to the sun at the Lick Observatory on August 7th was detected by at least one other astronomer, Professor Douglas in Arizona, and by an amateur, Dr. Emmert, of Detroit, while a bright streak in the sky, suspected to be a comet's tail, was later seen at Heidelberg. These records, to which others may later be added, make it very probable that the object was a great comet, passing very near the sun at perihelion.

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Electrical Devices

CURRENT REGULATOR FOR ELECTRIC FURNACES.—S. BURROWES, 30 McRae St., Niagara Frils, Ontario, Can. The invention has particular reference to a regulator adaptable to control the flow of current consumed in electric furnaces. It is an object to provide a regulator which will maintain the flow of current in an electric furnace as steady as possible, and to provide mechanism in which the length of the regulating impulse given to the control motor may be adjusted to meet the requirements of the furnace.

Of Interest to Farmers

PLANTER.—G. H. WRIGHT, 1925 W. Pacific Ave., Spokane, Wash. An object of the invention is to provide means for controlling the dropping of the seeds, which means is adjustable so as to provide for different sizes of seed and is automatic and driven by the traction of the planter over the ground. A further object is to provide means for opening and covering the seed trench. The device is especially designed for garden use.

ADJUSTABLE SEAT.—J. P. EAKIN, Box 63, Jollytown, Pa. This invention relates to seats for farm implements. An object is to provide a suitable mounting for a seat of the character above referred to so that the same may be adjusted for being supported in a horizontal plane when the implement with which the seat is associated is operating on an incline or on a hillside.

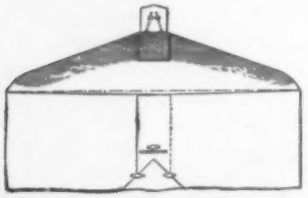
Of General Interest

APPARATUS FOR INDICATING THE CONDITION OF COAL COMBUSTION.—Z. OLSSON, 7-9 Hanover St., New York, N. Y. Among the principal objects of the invention are to produce a continuous record of the condition of coal consumption to avoid inaccuracies in the record, to obviate inaccuracies in the measurement of gases having variable temperature, and to cool and filter the gases before the same are delivered for measurement.

FISHHOOK.—A. F. THORSTEN, 1121 Flatbush Ave., Brooklyn, N. Y. An object of the invention is to so construct a fishhook that no danger of the same tearing the fish's mouth exists no matter how great the pull. A further object is to provide a construction which shall be extremely simple, its parts being such that it may be manufactured at small expense, at the same time be strong enough to reduce the danger of breakage to a minimum.

BARREL PROTECTOR.—W. F. MEEK, c/o Tu Tee Oil & Gas Co., Apartado, Tampico, Mexico. The invention aims to provide a device for protecting receptacles, adapted to be arranged within and extending throughout the entire length of the same, including in combination a pair of body bracing portions adapted to contact with the inner face of the receptacle, and means for connecting said bracing members one to the other.

LOCK FOR ENVELOPS AND OTHER CONTAINERS.—G. DOUTNEY, c/o Hard & Rand, 107 Wall St., New York, N. Y. The invention relates to envelops and containers of all kinds, and particularly to a lock therefor which will be out of sight, and will positively prevent any disengagement of the parts unless either the lock or some part of the container is cut, torn or otherwise mutilated, and has for its object to provide a construction which is easily applied and is positive in its action either in a comparatively stiff, or in a flexible container.

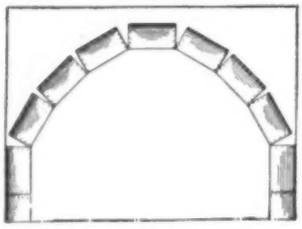


A PLAN VIEW OF UPPER PART OF ENVELOP IN OPEN POSITION

STOOL.—P. P. RILEY, 2403 Creston Ave., Bronx, New York, N. Y. The primary object of the invention is to provide a combined stool and mirror especially adapted for use by shoe salesmen, the said mirror being capable of being swung from an obscure position to a position in which it is used to display the foot and the shoe thereon; the mirror will move automatically to display position.

CONTAINER. — J. LEVY, 2161 67th St., Brooklyn, N. Y. An object of the invention is to provide a container in the form of a cup constructed of sheet metal formed from a single blank for the sides and a separate blank for the bottom connected to the side blank by a seam, while the side blank is seamed together in such a manner as to cause one end to project and thereby present a handle integral with the sides.

POULTRY DEVICE.—H. C. EVANS, c/o Craddock Terry Co., Chattanooga, Tenn. The invention has for its object the provision of a device adapted for use within a brooding room for preventing young chickens from



A VIEW OF BROODING ROOM FLOOR WITH INVENTION APPLIED

crowding in the corners or at the sides of the room and thus becoming smothered or unduly heated. The device comprises an inclined floor and a plurality of rollers mounted for rotary movement beneath the lower edge of the floor.

BANK BURGLAR PROTECTIVE DEVICE.—C. A. GUHR, 652 W. 43rd St., Chicago, Ill. An object of the invention is to provide a device by means of which a bank cashier may instantly protect himself from an armed robber. The invention consists of a movable screen which is normally out of sight but which may be instantly brought into position to screen the cage. A further object is to provide a device which is operated by an electric circuit from different points of the bank so that others may actuate the mechanism.

SELF-LINING INTERLOCKING BUILDING BLOCK.—J. J. MERREN, 2700 6th St., Port Arthur, Texas. The invention relates more particularly to an interlocking building brick which will permit of the formation of strong insulated and properly lined walls without the use of skilled labor, and with or without reinforcement as may be desired. In this construction painting is done away with, and the inner and outer surfaces are smooth, providing for effective decoration.

HOSE COUPLING.—F. W. BURNS, 1210 Franklin St., Johnstown, Pa. A purpose of the invention is the provision of a coupling which is of simple and efficient design and which can be readily attached to or detached from the ends of two sections of hose, and when in applied position to effectively connect the two sections in such manner as to prevent a leakage between them.

BIT.—H. L. DAUGHERTY, address V. Belanger & Co., 130 Osgoode St., Ottawa, Canada. This invention has for its object to provide a bit especially adapted for riding bridles, and wherein a bit bar is provided with a curb and cheek pieces in the form of plates extending above and below the bar, each piece having an opening at its top, and a tongue hinged to move transversely to form with the cheek piece a buckle, each cheek piece having a rosette forming a keeper below the opening.

DRESSING AND DYEING MOLESKINS.—H. GABBE, 115 Westminster Rd., Brooklyn, N. Y. The invention relates to the preparation of moleskins for use in fur coats, muffs, and other wearing apparel, wherein the natural color of the moleskin is maintained and rendered permanent and skin pliable. The dyeing solution consists of the following: Logwood dye, 50 parts; sal ammoniac, 25 parts; sumac, 25 parts; bluestone, 25 parts; antimony oxid, 25 parts; copperas, 50 parts. The dyeing operation lasts from ten to fifteen hours.

BALL COCK.—M. H. GREESON, 217 Lafayette St., Tampa, Fla. The primary object of the invention is the arrangement and disposition of the parts with the purpose of having the valve to seat not only in the direction of flow of water, but also in a downward direction so that it is capable of closing by its own weight, and will remain closed by the water pressure and its own weight as long as unaffected by the float controlled connections.

WATCH CHARM.—R. C. HOMAN, Chino, Cal. A purpose of this invention is to provide a watch charm including a body and a plurality of emblems detachably sustained on the body so that a person belonging to a number of lodges or societies can purchase separately any emblems and mount them on the charm body, it being the purpose to manufacture bodies and emblems separately.

SPRINKLER HEAD.—W. C. PENTY, Box 511, Columbus, Ohio. Among the objects of the invention is to provide a sprinkler head which is so constructed as to allow of the proper spreading and falling of the water on all parts of the area allotted for fire protection. Furthermore the invention allows a quicker and more efficient adjustment of the valve and prevents leakage of water from the head, the head being capable of quick assembly to facilitate installation.

SAFETY OIL CAN.—J. D. RICHEY, 209 Fancalua St., Corpus Christi, Texas. This invention has for its object to provide in an oil can, mechanism for securely closing the spout to prevent waste and evaporation, the said means being in the form of a cup or container holding a definite amount of oil, as for instance, enough to kindle a fire.

NECK SHAVING PATTERN OR GUIDE.—W. T. SESSOMS, 6237 Kenwood Ave., Chicago, Ill. An object of the invention is to provide a simple convenient and adjustable device by means of which one can shave his own neck, so as to give a symmetrical curve at the edge of the hair similar to that which is obtained at the hands of an expert barber. The device may be adjusted for use by persons having large or small necks.

PROCESS OF PREPARING MALTED FOOD PRODUCTS.—J. W. ALLEN, 3934 Walton Ave., Los Angeles, Cal. This invention relates primarily to the curing and seasoning of meats, but may be applied to other foods, such as vegetables, meat extracts, etc.; the process being economical in that it obviates the handling to which malted food products by the ordinary process are subject. An object is to provide a process of preparing malted foods in which a malt flavor is imparted to the products during the curing of the same.

ADJUSTABLE PICTURE FRAME.—A. PETNOW, 32 Coso Ave., San Francisco, Cal. The primary object of the invention is the provision of a picture frame of simple and inexpensive construction, which may be adjusted to receive pictures of different sizes. Another object is to provide a frame which need not be taken apart completely to effect an adjustment and which does not require particular skill to effect such adjustment.

PILLOW OR LIKE OBJECT.—C. S. BANKS, 322 Pitkin Ave., Ft. Collins, Colo. The object of this invention is to provide a pillow comprising three sections, the two end sections being identical and including relatively thick portions filled with non-compressible material, and a relatively thin central section between and connected to the end sections and filled with soft yielding material. The object being to provide a pillow which will be comfortable when the user is on his back or on his side.

ATTACHMENT FOR CIGARETTE HOLDERS.—W. L. WALLACE, Davidson, N. C. An object of this invention is the provision of an attachment for a cigarette holder by means of which a cigarette holder even when burned up to the holder, may be ejected without inconvenience and securely held within the holder against accidental displacement until it is desired to eject it.

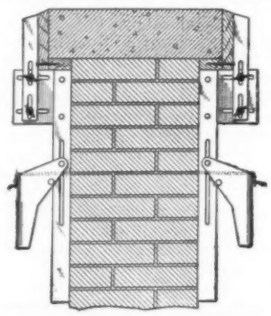
TOOTHBRUSH.—J. H. BOWMAN, Box 1174, Honolulu, Territory of Hawaii. This invention has for its object the provision of means to convert a sheet of paper of suitable size into a compact form so that it may be utilized one or more times as a toothbrush, and that when it is finally formed will present serrated surfaces particularly well adapted to reach every part of the teeth. Another object is to provide a simple, pliable handle on which the folded paper may be mounted.

TOOTHPICK HOLDER.—G. W. WALKER, 2207 Seminary Ave., Oakland, Cal. The invention relates to a holder having means whereby it may be attached to the end of a watch chain and carried in the vest pocket. The prime object is to provide a holder which may contain a supply of toothpicks, and is so constructed that a toothpick may be removed and inserted in an aperture comprising a handle, and thus used.

DISPLAY DEVICE.—C. I. OWEN, 396 E. 201st St., Yonkers, N. Y. The object of the invention is to provide a display device more especially designed for displaying burial and similar garments, and arranged to protect the garments against dust, to permit of conveniently changing the garments on the form, and to display the garments to the fullest advantage.

GLAZING CLIP.—H. M. LUTZ, R.F.D. 1, Box 106, Belmar, N. J. Among the objects of the invention is to provide a skylight or roof rail in the form of a T-beam having formed through or in the web portion thereof a series of holes or notches and with which the flexible tongue portion of a clip is adapted to engage and interlock, while the end or foot portion of the clip bears firmly against the outer surface of the glass plate.

MOLD SUPPORT.—J. J. MILNES, 55 Clinton Ave., Port Richmond, N. Y. The invention relates more particularly to a bracket for supporting concrete forms. Among the objects is to provide a collapsible device especially adapt-



A VERTICAL SECTIONAL VIEW OF WALL, SHOWING DEVICE IN USE

able for supporting forms to provide cappings for walls. A further object is to so construct the bracket that it is adjustable, thereby adapting itself to forms of various sizes.

COVER AND SUPPORT FOR CARRIERS.—R. P. ORR, 35 S. Manning Blvd., Albany, N. Y. The invention relates to a cover construction which may be easily manipulated and which will not interfere with the action of the supporting straps. An object is the provision of a carrier and cover together with means for supporting the same, arranged to extend through the cover without interfering with the operation thereof and support the carrier from an interior point.

ALLOY.—F. MILLIKEN, 18th Floor, 110 William St., New York, N. Y. The object of the invention is to provide an alloy characterized by pronounced density and ability to withstand pressure, also to resist nitric acids, nitrate derivatives, ammonia, picric acid and other similar acids having deleterious influences when subjecting ordinary aluminum alloys to the action thereof. The alloy consists of aluminum 89-94 per cent, lead 5-10 per cent.

ENVELOP.—J. P. DE VAUGHN, 1078 Ellicott Sq., Buffalo, N. Y. An object of the invention is to provide an envelop having a closing flap easily manipulated in opening and closing the same, in which the contents are securely held although the envelop is not sealed, and which may have two addresses or other inscriptions permanently applied thereto although one only at a time is visible when the envelop is in use.

SILO OR FILLING TRUNK FOR POWDER OR GRANULAR MATTER.—K. LUFT, Darmstadt, Germany. The object of the invention is to provide an apparatus of this class from which powdered or granular matter can be discharged in a uniform flow. The apparatus comprises a trunk having a discharge at the bottom and a plurality of irregularly spaced bars for breaking up the material as it moves downward.

(*Continued on page 246*)

Anchoring Fly-a-way Seeds

IN neighborhoods subject to long dry spells it is an important matter to plants to get their seeds underground as soon as possible, especially if the location is windy. One of the methods by which they accomplish this is by exuding a sort of natural mucilage as soon as they obtain any water. A German botanist studying plants in northwest Africa, found that out of 906 varieties more than 36 per cent, 332 to be exact, are marked by this feature. In studying them he found that after being wetted and then dried they adhered strongly to whatever lay beneath them, whether this was filter paper, earth, or the slide of a microscope. The first rainfall, therefore, literally glues them to their places, giving them a foothold to start their struggle for existence as soon as the needed rainfall comes, even a heavy dew will sometimes suffice to liberate the "glue." This anchorage to the ground also serves the purpose of assisting the young root to make its way into the soil, as well as the sprouting plant to escape from its imprisonment within the seed. A writer in the monthly supplement of the *Chemiker Zeitung* (Berlin), remarks in describing this phenomenon that the plants must ripen their seeds before the beginning of the summer drought and most of them do this, but a few kinds bloom so late that the fruit does not ripen until the beginning of the winter. Others in which the fruit ripens in May or June, do not let it fall until the end of the dry season, and in a third group the fruits do not open until there comes a steady downpour, even if they have to wait a year for that blessing. Tests made of 50 varieties of desert plants proved that the seeds of most of them open very shortly after they are watered, showing that the plants are ready to make use at once of the heavenly gift of moisture.

Cement-Coated Nails and Their Origin

CEMENT-COATED nails were invented by Ira Copeland, Brockton, Mass., prior to 1915, says H. A. Knight, a writer in a leading trade paper. Prior to their being made in the United States, they were seen here only when they came in imported packages and were known as French nails. The inventor noted that the lumber in which these French nails were driven was very resinous. Upon experimentation he found that when they were cleaned and driven into our native lumber they did not hold any better than American nails.

He then experimented with various combinations of vegetable gums, which resulted in a patent issued to him in May, 1887. Since Mr. Copeland was a school teacher and not in a position to engage in manufacturing, he sold licenses to manufacture under his patent to about 25 concerns scattered over the United States and Canada. Only at Whitman, Mass., however, was any serious attempt made to manufacture and market this product, and this was done under Mr. Copeland's observation and assistance.

In the early nineties James C. Pearson bought Mr. Copeland's interests and recalled by purchase most of the outstanding licenses. He secured Pittsburgh manufacturers to make the nails for him, all of whom are now either out of business or incorporated in the American Steel & Wire Company.

The first attempts at commercial coating were made by using a very complicated machine, also the invention of Mr. Copeland, which gave slow output and inferior product as compared to that of today. Upon moving to Pittsburgh Mr. Pearson simplified the process, using a simple tumbling oven, which was later developed by the leading interests in the coated nail business into efficient and speedy machines.

Many carpenters are prejudiced against the use of such nails, because they cannot place them in their mouths and because they soil the hands. In packing delicate goods there is objection sometimes lest they soil the goods. Because of their extreme holding power they are not suitable to house-finishing work or cabinet work where boards may have to be taken off for replacement or adjustment.

A cement-coated nail is of mottled appearance, with blotches of the glue-like brown coating, through which shows the steel color of the nail. The heat of the hands slightly melts the coating and makes it sticky. The growth of its use has kept pace with the growth in the use of wire nails. A recent adaptation was that for the wooden molds for the concrete of the Princeton stadium.

There are many manufacturers of this product on a small scale in the United States. Some have attempted to use paints or varnish, but the resinous mixtures seem to have been the most successful.

Approximately one-tenth of the wire nails manufactured are cement-coated, according to R. L. Foster, president of J. C. Pearson & Co., Inc., Boston, the largest producers of coated nails in the country. Such nails have been given a shaking up in a hot tumbling barrel with a compound consisting mainly of resin, from which they issue with a thin, tough coating which greatly increases their holding power. The friction of the driven nail with the wood melts the cement and forms a glue, which makes fast the nail.

The product is used principally in wooden packing cases of all kinds, including boxes, barrels, crates. It is claimed that by their use there is less loss because of broken packages, less loss by theft because of the difficulty of prying open the cases and because of the squeak incident to the extracting of the nails. It is said that but one coated nail need be used for every two plain nails.

Coloring Oranges With a Gas Engine

THE marketing of Satsuma oranges is being speeded up by an artificial process of discoloration developed by the Office of Horticultural and Pomological Investigations of the United States Department of Agriculture. Laboratory tests at the Government farm, Arlington, Va., reinforced by more eleborate experiments in Baldwin County, Ala., have determined the feasibility of applying an attractive coloring to oranges by exposing the fruit to an atmosphere of gases formed by an imperfect combustion of kerosene and other petroleum products.

The Satsuma orange, strange to say, reaches its most inviting state for consumption several weeks prior to the attainment of a yellow color. If permitted to remain on the tree until it assumes the characteristic hue of a ripe orange, the fruit is robbed of its fine flavor. The tendency is for this variety of orange to become flat and tasteless. The time-honored habit of the buyers of oranges is to specify a fruit with a yellow color, long considered as the only sure earmark of a ripe orange. Obviously, the fruit salesman is at a disadvantage in marketing the green-colored specimens.

Hence the efforts of the Bureau of Plant Industry in devising a method of artificial discoloration, which to appearances would seem to hasten the ripening process where nature left a gap between immature coloring and premature readiness for market when judged by the juicy mixture. A gas engine in operation at the Government experiment farm in Virginia cures the skin or gives the desired yellow coloring by subjecting the fruit to an atmosphere of gases. Similar experiments in the orange groves of Alabama fortify the laboratory conclusions as to the practicability of the novel procedure. The oranges are cured in from three to five days, the products thus treated being accorded prices in excess of the uncured fruit taken from the Satsuma trees.—By *S. R. Winters.*

RECENTLY PATENTED INVENTIONS

(Continued from page 244)

Hardware and Tools

FISHING TOOL.—J. T. MALONEY, 918 S. Quaker St., Tulsa, Okla. The object of this invention is to provide a tool of the character specified for finding and removing lost bits of other tools from a well, wherein the fishing tool comprises a socket for receiving the end of a lost bit or other tool, having means for tightly gripping the lost tool to permit the same to be withdrawn.

WRENCH.—C. A. KLOPFER, 214 11th Ave., Asbury Park, N. J. The invention relates to a gear drive socket wrench which can be conveniently used for removing or replacing nuts which are awkward to reach. An object is to provide a socket wrench which can be operated to lock the socket against turning movement to permit the full leverage of the wrench to be employed for loosening a nut and then enable the socket to be turned by the gear driven mechanism to complete the removal of the nut.

WRENCH.—E. T. KNITTER, 3583 W. 67th St., Cleveland, Ohio. The invention has for its object to provide a wrench, wherein a shank is provided having a fixed jaw and a movable jaw, the movable jaw and the shank having interengaging means for locking the movable jaw in adjusted position, and wherein the shank is calibrated for cooperation with the movable jaw as an indicator to indicate the position with respect to the fixed jaw.

BIT AND DRILL GUIDE.—F. FYRON, 315 E. 29th St., New York, N. Y. This invention relates to drill and bit guides adapted for cutting mortises for installing locks in doors. The device comprises a clamp to be attached to the door, a drill bit support attached to the clamp and means for moving the support longitudinally and laterally with respect to the door.

LOCKING BOLT.—W. HACKETT, 680 32nd St., Oakland, Cal. The primary object of the invention is to provide means which may be conveniently used for temporarily or permanently clamping plates or the like, the device being especially adapted in connection with ship building where it is desirable to clamp two or more plates together preparatory to riveting or otherwise fixing them together.

VISE.—E. S. LIDSTONE, Box 203, Gatun, Canal Zone. An object of the invention is to provide a device having rotary motion upon a support and to provide means associated with the support for selectively preventing or permitting such rotary movement, so that the work may be rotated without removing it from the jaws of the device. A further object is to provide a device which will be simple, practical and strong.

Heating and Lighting

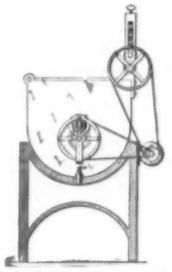
HOT AIR CANDY COOKER.—ELIZABETH A. CASEY, 301 Morewood Bldg., East End, Pittsburgh, Pa. The invention particularly relates to hot air cookers capable of advantageous use in the making of candies, jellies, jams and preserves, the object being the provision of a cooker in which the heat is confined and regulated so as to bring the syrup or other material to the required high temperature in the quickest possible time and to eliminate all possibility of burning or scorching the material in course of preparation.

IGNITER.—G. A. LEY, 1627 Carmen Ave., Chicago, Ill. This invention relates to a flash light powder igniter, particularly adapted for use by photographers. The object is to provide an igniter in which the sparks to ignite the flash powder are projected directly into the flash pan in which any possibility of premature ignition is precluded and in which all phases of the operation are completely controlled in order to provide against accident.

Machines and Mechanical Devices

CLOTH GUIDING DEVICE FOR CLOTH FINISHING MACHINES.—W. A. HOGAN, 749 Patten St., Danville, Va. This invention relates generally to cloth guiding devices and more particularly to an apparatus designed to hold moving fabric out to a smooth surface and prevent wrinkling or doubling previous to its passage into the rolls of calender or other cloth finishing machines such as brushing machines and others well known in the finishing of fabrics.

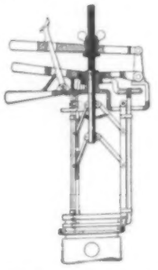
WASHING MACHINE AND GEARING FOR SAME.—F. H. MAYER, 254 Elate St., Denver, Colo. The inventor has been granted two patents relating to the same subject matter, one has for its object to provide a washing machine with a clothes cradle made of strong wire mesh but given a corrugated shape to produce a wash-board effect; the cradle has no interior rods or projections which would tend to cause the clothes to become entangled.



ILLUSTRATING THE APPLICATION OF THE GEARING TO A WASHING MACHINE

The other invention provides for a mutilated drive gearing for oscillating the clothes cradle so as to wash the clothes and a continuous gear for revolving the cradle to expel the water from the clothes.

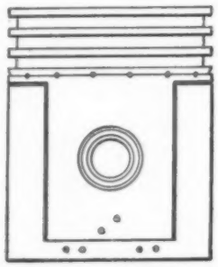
PISTON RING PLACER.—E. MCPEEK, Sardis, Ohio. An object of the invention is to provide an apparatus which will expand a piston ring, hold it in proper position on a piston and eject the ring into a piston groove.



A VIEW PARTLY IN ELEVATION, BUT MAINLY IN VERTICAL LONGITUDINAL SECTION

A further object is to provide an apparatus which is capable of use in connection with any size of piston ring and which can be quickly and conveniently manipulated.

PISTON.—H. W. PIERCE, 53 E. Broadway, Butte, Mont. The invention relates more particularly to pistons for internal combustion engines, an object being to provide a piston



A VIEW IN SIDE ELEVATION

which is constructed mainly of aluminum, but which is reinforced by a cast iron section to take the load caused by the angularity of the connecting rod and hence insure an accurately fitting piston of long life yet mainly of aluminum.

Railways and Their Accessories

LOCOMOTIVE DRIVING BOX.—F. CANNON, Hamlet, N. C. The invention relates generally to locomotive driving boxes, and more particularly to a driving box having for its primary object the support of a bearing brass in such manner and of such nature as to greatly outlast the usual bearing brass and render more efficient and effective service throughout its life, and provides for its ready renewal when necessary.

Pertaining to Vehicles

TRACTION DEVICE.—H. E. HOUSTON, 301 Lee St., Wichita Falls, Texas. The invention pertains more particularly to traction devices adapted for attachment to wheels of motor vehicles to enable the wheels to obtain a better grip on soft roads, mud holes, and the like. The device may be readily attached and detached from a motor vehicle wheel, and is constructed in such manner as to be adjustable to wheels of various dimensions.

TIRE. — V. KUBELKA, 1817 Bleecker St., Brooklyn, N. Y. The principal object of the invention is to provide a resilient filler for tire shoes which will obviate the use of pneumatic tires on vehicles of all descriptions. A further object is to provide a puncture-proof construction which may be readily installed which will be strong and durable in use and which will greatly prolong the life of the tire shoe.

FRICTION CLUTCH.—A. C. JACOBI, address A. E. Bessey, Sunnyvale, Cal. The invention more particularly relates to an automatic one-way friction clutch, which while adapted for use on any machines or vehicles involving a drive element, is especially adapted for use in cranking automobiles. An object is to provide a friction clutch which will instantly cause the driven element to be engaged in the clutching movement and which will automatically release the driven element.

ANTI-SKID DEVICE.—V. KUBELKA, 89 McDougal St., Brooklyn, N. Y. This invention relates to that form of anti-skid device commonly known as a tire chain, an object being to provide a form of tread member associated with a pair of annular chains. A further object is to provide a device which will be simple and practical in construction, strong in use, and a device which may be quickly applied or removed.

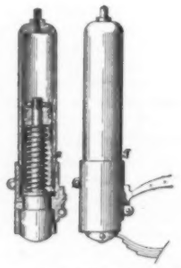
LICENSE PLATE HOLDER.—H. BREWSTER, 69 5th Ave., New York, N. Y. The invention relates to plate holders usually positioned upon the rear parts of automobiles. An object is to provide a plate holder in which the plate may be so positioned that it may be sealed so as to prevent unauthorized removal. A further object is to provide means by which the license number may be readily read after dark, and may also serve to indicate the direction in which the vehicle is about to turn.

DUMP CAR LATCH.—W. J. RUNDLE, 137 Wing Ave., Meaderville, Mont. An object of this invention is to provide a locking mechanism for dump cars which is located entirely under and within the car. A further object is to provide a latch mechanism which will be comparatively cheap to manufacture, which may be readily installed and which will be practical and durable in use.

DEMOUNTABLE RIM.—H. M. HOWELL, Monroe, La. The invention more particularly relates to a rim of the type employing a removable outer tire retaining flange. An important object is to provide fastening means for the outer removable tire retaining flange in which the fastening action is equally and evenly distributed along the entire circumference to provide the greatest strength and prevent distortion of the various parts.

RESILIENT TIRE.—W. R. SHAW, c/o R. B. L. Co., 43rd St. and 8th Ave., New York, N. Y. The invention has reference to a resilient member adapted to be placed on the inside of a tire casing. An object is to provide a resilient filler for a rubber casing which will be puncture proof and which will be fully equivalent to a pneumatic cushion when traveling.

SHOCK ABSORBER.—L. F. FITZGERALD, Box 156, Oilfields, Cal. This invention has for its object to provide a device of the character specified adapted for use with motor vehicles and designed to act as a resilient



A LONGITUDINAL SECTION AND FRONT VIEW

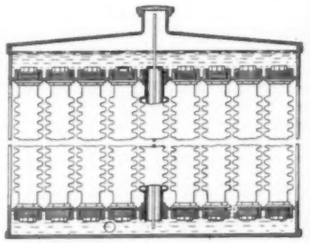
load carrier and as a snubber for cushioning the recoil. The device is of cylindrical form, in two sections within which are arranged a plunger and coil spring. The valve permits the free entrance of air, but restricts the outward flow of air when the plunger moves toward the valve.

AUTO TIRE LOCK.—W. A. RIGAL, 678 Milwaukee Ave., Chicago, Ill. An object of the invention is to provide a simple, relatively inexpensive device for securing an automobile tire in adjusted position on a tire carrier. A further object is to provide a device that has members adapted to encircle the rim of a tire carrier, and is provided with a permutation locking mechanism, wherefore unauthorized removal of the tire cannot be accomplished without breaking the locking device.

CARBURETOR LOCK.—C. E. NORTHRUP, 2104 W. 2nd St., Dayton, Ohio. The special object of the invention is to provide a lock designed to cut off the supply of gasolene or other liquid fuel from the needle valve, thereby preventing running of the engine by unauthorized persons. Another object is to permit of conveniently applying the lock to carburetors as now general constructed.

DETACHABLE TRUCK BODY FOR AUTOMOBILES.—J. K. SHANNON, address Fred Fair, Atty., Marshall, Mo. This invention has for its object to provide a truck body which may be easily and quickly attached to or detached from a Ford runabout, for instance, and wherein means are provided for reinforcing the springs of the vehicle, said means being arranged between the rear axle and the detachable truck body.

RADIATOR.—A. NEBEL, 794 Knickerbocker Ave., Brooklyn, N. Y. The invention relates to liquid cooling devices, and is particularly adapted for use as a radiator for automobiles, but may be used wherever it is desirable to



A VIEW PARTLY IN SECTION, SHOWING THE ARRANGEMENT OF TUBES

cool a circulating liquid. Among the objects is to provide a radiator having its parts so constructed as to bring the circulating fluid in contact with a large exposed surface whereby the liquid may be effectively cooled, in a limited space.

RESILIENT WHEEL.— A. N. Y. MARTINEZ, P. O. Box 665, San Juan, Porto Rico. An object of this invention is to provide a construction wherein resiliency is secured through the use of compressed air operating at the end of reciprocating spokes. Another object is to provide a comparatively stiff rim having hinged spokes and means associated with the hub which will take up the shocks and resiliently limit the swinging movement of the spokes and the movement of the rim.

GEARING FOR VEHICLE SIGNALS.—H. C. CARSON, 3831 Olivette Ave., Station L, Cincinnati, Ohio. An important object of the invention is to provide a vehicle signal for street railway cars and automobiles, which is simple and durable in construction, and which may be controlled by the operator without detracting from his capacity to control the vehicle, and which will effectively advise adjacent vehicles of intended change.

Designs

DESIGN FOR A TOY HORSE AND JOCKEY.—R. MELRONE, address Stewart Hale, 229 Columbus Ave., New York, N. Y.

DESIGN FOR A RADIATOR CAP ORNAMENT.—L. K. WOODARD, 10 S. Terrace Ave., Mount Vernon, N. Y.

DESIGN FOR A DOLL.—E. MALAVARCA, 331 S. 7th St., Newark, N. J. The inventor has been granted two patents on doll designs.

DESIGN FOR A SETTING FOR PRECIOUS STONES.—H. BRESLAVSKY, 41 Maiden Lane, New York, N. Y.

Showing the Earth's Movement

IT is commonly supposed that it is not possible to demonstrate the movement of the earth without elaborate apparatus. This is very far from being the case as a simple device will indicate the earth's motion.

In the first place select a room that is fairly free from vibration. Then obtain a good-sized bowl or tub a foot or more in diameter and rather deep and nearly fill it with water. Place this on the floor of the room in such a position that it need not be disturbed for some hours. Get some finely powdered resin and sprinkle a coating of this on the surface of the water. Any fine substance that would float and not be dissolved for some hours would do as well. Next secure a little coal dust and sprinkle some on the top of the resin doing this in a straight line from the center to the circumference. Carry this line up over the rim of the bowl, and make it broad enough to be clearly seen—say about an inch in width.

The bowl may now be left for several hours at the end of which time it will be noticed that an interesting thing has happened. It will be seen that the line on the surface of the water has changed its position and that it no longer meets that which runs up over the rim of the bowl. As a matter of fact the black line on the surface of the water has swept around from east to west.

What has happened is this: The water in the bowl has stood still throughout the time which it has been left while the vessel itself has been carried around by the motion of the earth from west to east. Another way of putting it is that the earth has swung around through a considerable arc from west to east, leaving the water quite stationary.—By *S. Leonard Bastin.*

New Cold Method of Making Porcelain

FOR hundreds of years the firing of porcelain has been a *sine qua non* in its manufacture. Word has just come from Germany that a Jena engineer named Menkel has invented a process by which the ware can be completed without firing, although it exhibits all the desirable quality of porcelain which has passed through the kiln. The chief constituent is kaolin, as usual, but this is mixed with various other materials and a special "binder" to form a porcelain-like mass. The hardening process is a secret, but we are assured the finished product is not at all inferior to the kiln-baked ware. Painting is unnecessary, since various tints and colors are imparted by the admixture of mineral colors. The articles made of this unfired porcelain leave the molds without trouble. The material is especially suited for the making of buttons which closely resemble those made of vegetable ivory. It can also be used for making insulators, pipes, ornaments, etc.

Fertilizers from the Mud of the Nile

FERTILIZER manufacturers and others are constantly looking for potassium but its recovery from the sudd or mud of the Nile River in Egypt is a novel suggestion. It is only a new suggestion for the use of this material which has had various schemes proposed for its disposal. The new scheme of recovering potash from it comes from an Englishman.

Starting from the basis that one ton of dry sudd contains about one-fifth of the thermal energy in a ton of coal, together with about 45 pounds of potassium salts, he would in one process burn the sudd in a gas-producer plant. The gas would drive a gas engine and dynamo, and the current generated would be used to electrolyze the potash salts obtained by lixiviation of the ashes for the production of hydroxide, or to make nitric acid from the air, the acid being then allowed to

react with the salts for the formation of nitrate.

In another process he would burn the sudd to charcoal in an oven heated by the sudd, and use this charcoal for the manufacture of cyanide, from which he would obtain nitric acid, via ammonia, which again could be combined with the potash salts to form nitrates. He states that this sudd charcoal is free from sulfur, and that with it, owing partly to its physical condition and partly to the contained alkali, the reaction proceeds rapidly at much more economical temperatures than with coal or coke, which require high temperatures.

French Utilization of Fish to Replace Meat

PRICES for meat in France have become so high, reports the Commercial Attaché at Paris, that many people have been forced to discontinue purchasing. Indications are that the situation will become worse during the winter. Frozen meat now costs almost as much as fresh meat. This has led to a revival of the campaign in favor of the consumption of fish to replace meat. Much has been said and written about what should be done in this connection, and the result has been a certain increase in the cold storage and transportation facilities to handle shipments of fish to interior cities.

The Association Française du Froid has undertaken vigorous propaganda work in order to bring to the attention of the public the necessity for a wider application of refrigeration in the handling of fish. It is pointed out that France will have to face a deficit of 300,000 or 400,000 tons of meat per year for some years to come. This deficit must be filled by imports of frozen meat or by the utilization of fish.

It is estimated that 30 to 35 per cent of the fish brought to French ports does not find its way to the cusomers, being spoiled for lack of refrigeration.

Plans have been made at Lorient for a demonstration favoring the consumption of fish at which the Undersecretary of State for the Merchant Marine will be present. Models of fishing vessels equipped with motors, cold-storage cars, and in fact everything connected with the catching and distribution of fish will be shown.

The Government has interested itself very much in the matter of distribution of fish to the consumers.

What Has Been Said About Einstein

IN order to have *position* in a manifold one of whose dimensions is time, a thing must have position in time—it may not merely exist but it must happen—it must cease to be a thing and be an event. For the most part Dr. Slosson escapes confusion of this sort, or at least does not get too explicitly tangled up in the web of time and space; but when he lists as typical elements in the space-time manifold "your pencil, the discovery of America, the sun and next Friday," he allows the popular style to run away with him and get him badly bunkered. The mathematically inclined reader will recognize readily that only one of these items is really an event, corresponding, in the space-time manifold, with the point in the Euclidean geometry of two or three dimensions that we learn in school. For the sun and the pencil possess *extension* in time rather than mere *position* therein, just as a line possesses extension in one of the three dimensions of space and position in the other two. So the sun and the pencil, if for the sake of argument we assign them position rather than extension in the three dimensions of space, correspond to the line in ordinary space—they are in fact lines extending in the time direction; while next Friday, possessing extension in three dimensions of space (it is Friday everywhere, within reasonable limits) and in the one dimension of time, actually corresponds to a complete figure like a cube, sphere, cylinder, etc., of three dimensions in three-space. Indeed, to the non-mathematical mind it must seem altogether extraordinary that, from the viewpoint of the four-dimensional geometer of space-time, the act of dropping a pencil on the floor or of looking at the sun represents a configuration of more elementary character than the pencil or the sun itself—a configuration possessing only position in the time dimension, rather than extension, and so on the level of a point rather than of a line.

NEW BOOKS, ETC.

AN OUTLINE OF PHYSICS. By L. Southerns, M.A., B.Sc. New York: E. P. Dutton and Company. 8vo.; 202 pp.; illustrated.

Unusual in arrangement, this text aims at inspiring keenness in the student, imparting solid instruction in the subject, and presenting matter of use in his future. It begins by meeting the student on his own ground by impressing upon him the utility of the instruction. The newer knowledge is embodied in the course itself, and the plans of study inculcate real working ideas.

THE MANAGEMENT AND THE WORKER. By George F. Johnson and others. New York and Chicago: A. W. Shaw Company, 1920. 8vo.; 228 pp.; illustrated.

Manufacturers, factory executives and managers will find suggestions of timely help in this volume in which the experiences of well-known manufacturing firms are narrated by men identified with the firms' successes. The contributions tell how to build up "a seaworthy labor policy," give examples of "personal" management, describe the "house and senate" plan, explain the Whitley report, and treat in detail all questions of labor routine.

MECHANICAL DRAWING. By Franklin D. Jones. New York: The Industrial Press, 1920. 8vo.; 342 pp.; illustrated.

This new work is distinguished from ordinary texts on the subject by its emphasis on the actual methods of up-to-date drafting rooms in machine building plants. Origination and development of design, in distinction from the mere representation of it by a drawing, is a matter upon which great stress is laid. The treatise will greatly advantage the student in the school and the beginner in the shop, enabling them to grasp the relative practical importance of elements and details.

FILES AND FILING. By Ch. Fremont. Translated by George Taylor. New York: Isaac Pitman and Sons, 1920. 4to.; 148 pp.; illustrated.

Anyone interested in the technology of file-making will appreciate this authorized translation of M. Fremont's basic work by an English expert. The versatility and originality of the treatise is faithfully reflected in the translation. The origin and evolution of the file, cuts, tests, and uses, are set forth instructively and suggestively, with illustrations supplied from the rich collection of the author.

KEPLER. By Walter W. Bryant. New York: The Macmillan Company, 1920. 12mo.; 62 pp.; portrait.

In the entertaining style characteristic of the "Pioneers of Progress" series, this compact biography places before us the pre-Kepler astronomy, delineates Kepler's early life, shows his indebtedness to Tycho Brahe's observations, cites his laws, and summarizes his closing years. The usual appendices of dates and bibliography are to be found.

THE STEAM RAILWAY LOCOMOTIVE. By E. L. Ahrons, M.I.Mech.E., New York: Isaac Pitman and Sons. 16mo.; 114 pp.; 26 illustrations.

In the small space at his command the author has by scrupulous selection and strict economy of words given the student clear descriptions of British locomotive types, mechanisms and valve gears, carriages and tenders. Compounding and superheating are discussed, and often the reasons leading to the adoption of the principal parts that make up the locomotive are given.

JOHN DALTON. By L. J. Neville-Polley, B.Sc. New York: The Macmillan Company, 1920. 12mo.; 63 pp.; portrait.

A brief but satisfying summary of the life and work of the great English chemist. It sketches the evolution of the atomic theory, follows Dalton in other important investigations, and has a table of dates and a bibliography.

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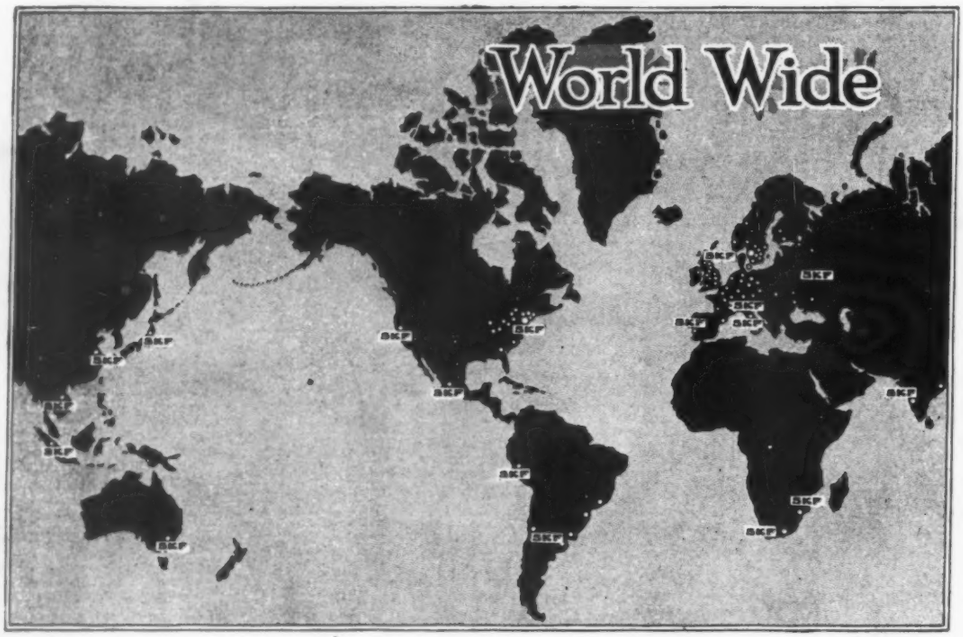

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